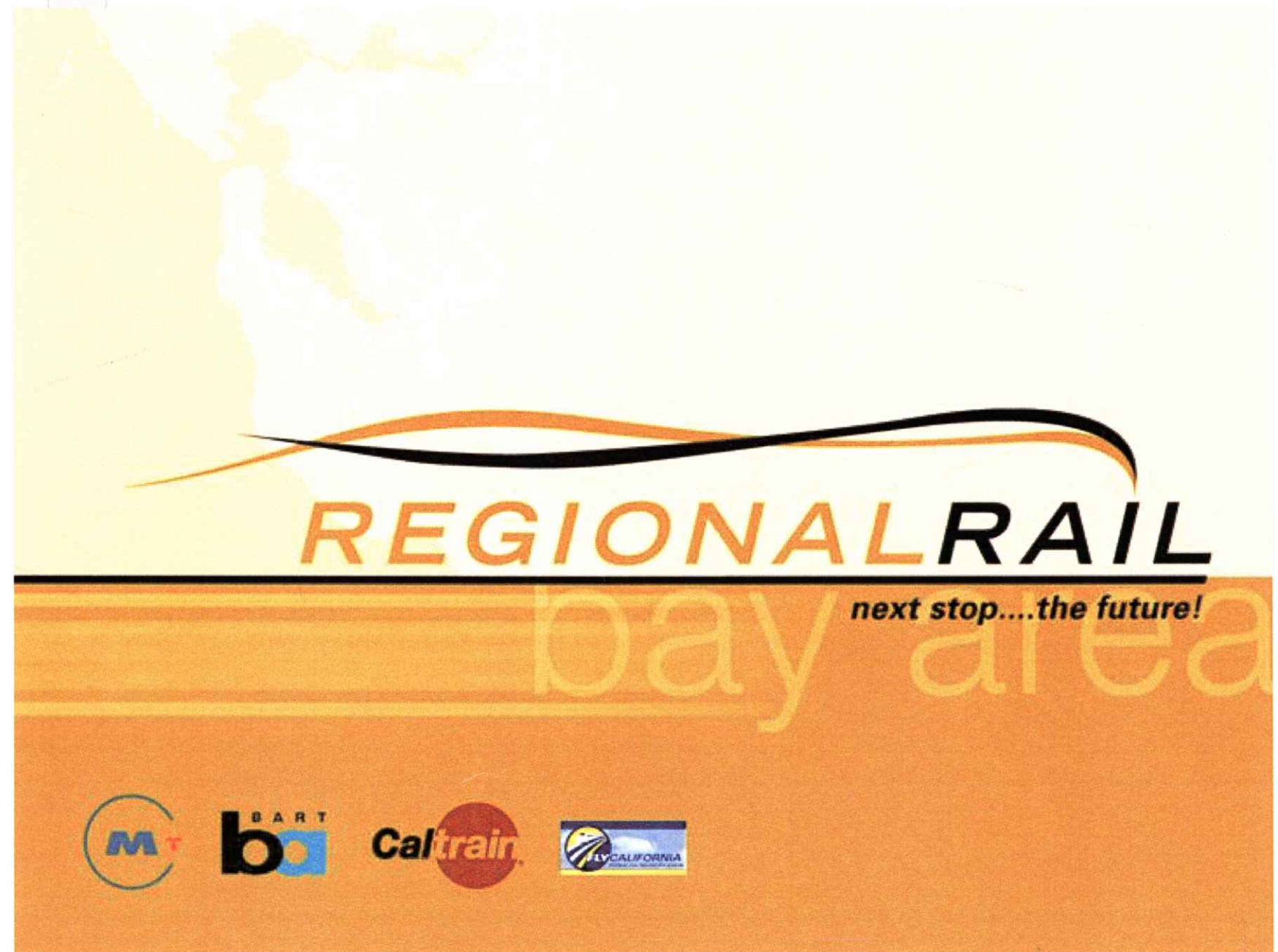


BAY AREA REGIONAL RAIL PLAN

Technical Memorandum 4b
Conceptual Civil Engineering and
Major Bay Crossings

April 4, 2007



Conceptual Civil / Structural Engineering and Major Bay Crossings

Scope of Work

For each study alternative, Consultant shall perform conceptual civil engineering of railroad track, grading and subgrade construction, incidental structures, stations and maintenance, servicing and layover facilities. For each study alternative, Consultant shall perform conceptual structural engineering with consideration for geotechnical factors for major structures, including conventional railroad and / or high speed rail crossings of San Francisco Bay and the Carquinez Strait.

(Costs will be developed under Technical Memorandum 4c, Engineering Environmental Issues and Costs, Capacity issues for the corridors have been addressed within Technical Memorandum 4g, Principal Stations have been developed under final Technical Memorandum 4j dated January 31, 2007.)

General

For both study alternatives, see Alternative 1 and 2 we have prepared conceptual and structural engineering plans for portions of the corridors. The major Bay crossings for the regional rail system have also been prepared; including plan and profiles along with conceptual structural design. These crossings include the Dumbarton crossing, the Richmond – San Rafael Bridge and the Carquinez Bridge. The Dumbarton Bridge corridor has been designed for both regional rail and high speed rail systems. Three alternatives have been prepared for the Dumbarton Bridge; a tunnel, a low level bridge with two movable spans and a high level bridge.

A new high level bridge crossing for the existing Benicia Bridge was reviewed to replace the existing low level span with a movable span for the marine traffic. Two alignments were developed but each had significant shortcomings and were not developed further. The shortcomings were it either did not meet UPRR criteria or had significant impact on wetlands and wildlife areas. Consequently, no conceptual bridge was developed for the Benicia crossing.

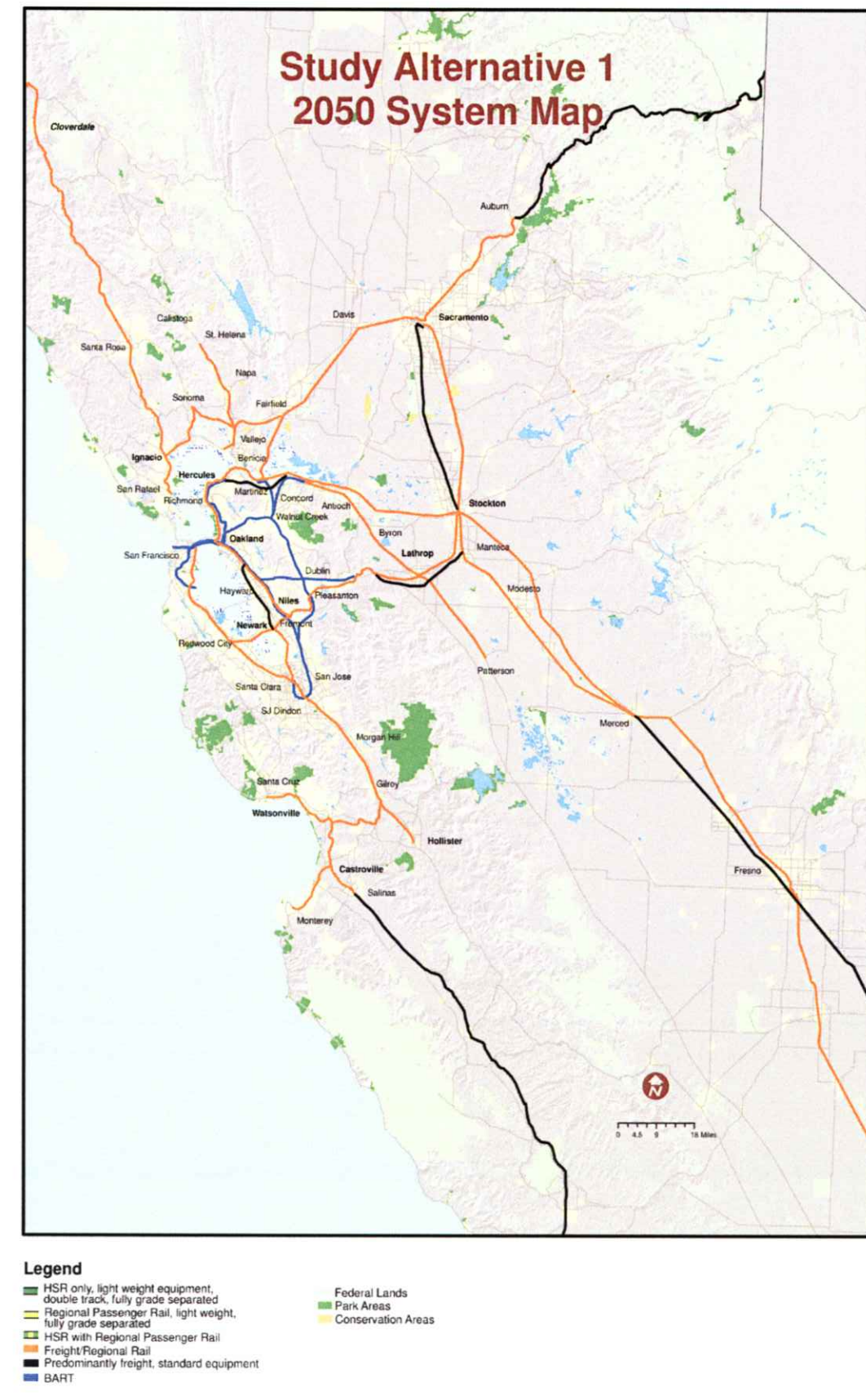
The engineering criteria for the UPRR and the BNSF have been incorporated into the appropriate corridors. When appropriate, the structures were designed to UPRR criteria.

Conceptual engineering plans and profiles were developed for corridors that involved generally new alignments. For existing corridors that are to be retained for service no plan and profiles were developed. New cross sections for these existing corridors and their implications are discussed as part of this technical memorandum. The sections assume that the host railroads criteria for track, ballast, grading and sub-grade will be incorporated.

New BART corridors were designed for the potential new Bay crossing, the Oakland fourth track option, the Livermore connection to a Station at Isabel and portions of the I-680 alignment. Two options were designed for the San Francisco and Oakland end of the bay crossing, along with plan and profiles for the Bay Crossing tubes.

Stations are as indicated in Technical Memorandum 3b, Appendix A. The cross sections shown for the various corridor sections have been developed and coordinated with technical memorandum 4g – Summary of Capacity Issues.

The High Speed Rail corridors have been developed under a separate work task and are not included in this technical memorandum. Input from the high speed rail study alternatives are incorporated into study alternative 2, lightweight service (non-compliant) as the regional choice.



Existing Corridors

Typical mainline cross sections have been developed for the following corridors with the stated assumptions regarding track capacity. The applicable section number is in parenthesis (x).

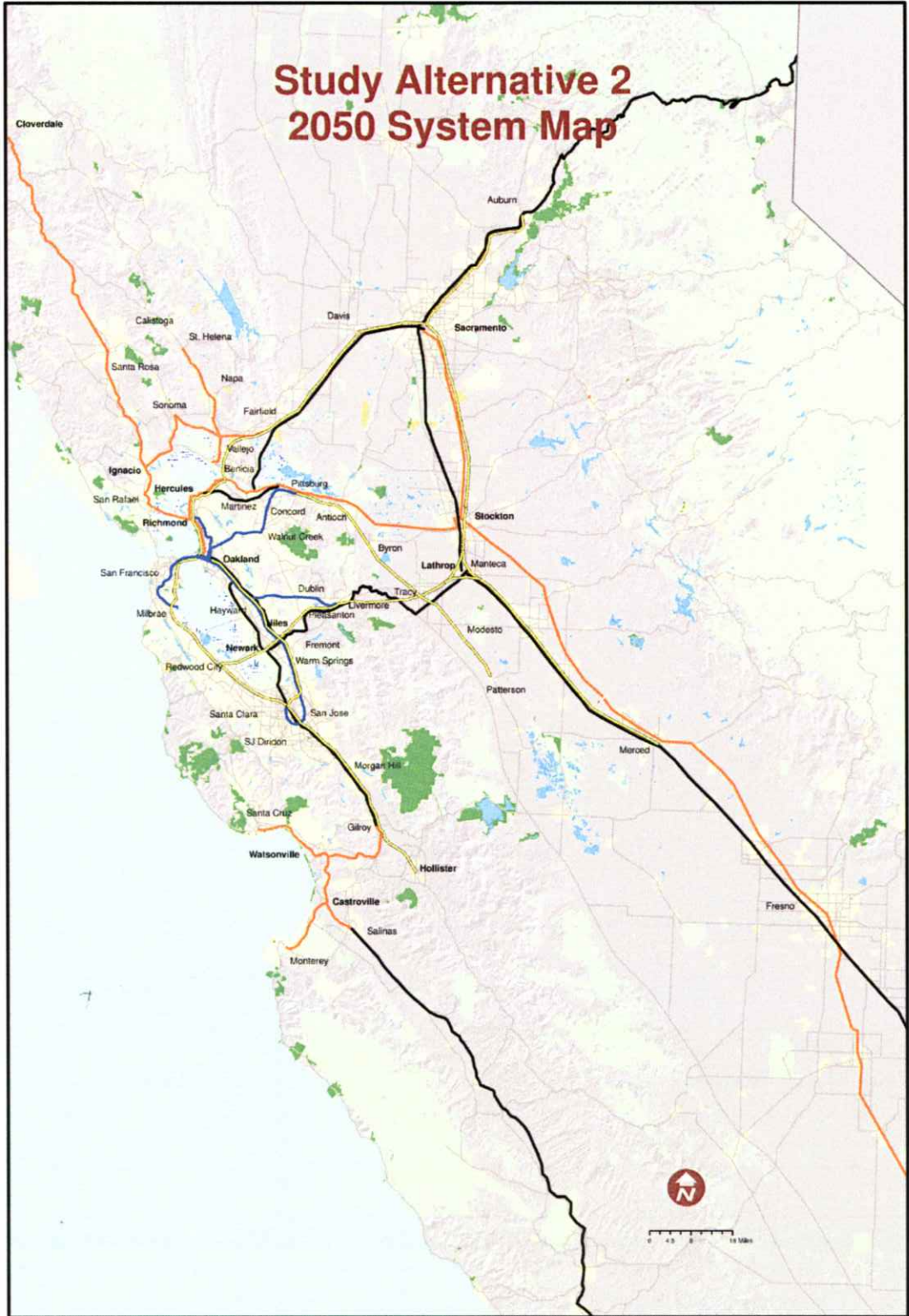
Corridor	Alternative 1	Alternative 2
• Smart Corridor	Single track with 2,500' station sidings (1)	Same as Alt 1 (1)
• Ignacio to Fairfield/Suisun	Single track with 2,500' station sidings (1)	Same as Alt 1 (1)
• St. Helena to Vallejo	Single track with 2,500' station sidings (1)	Same as Alt 1 (1)
• Sacramento to Richmond	Triple track (3)	Four track (4)
• Richmond to Oakland	Four track (5)	Four track (4)
• Auburn to Sacramento	Triple track (3)	Four track (4)
• Stockton to Richmond	Double track (2)	Same as Alt 1 (2)
• Lathrop to Martinez	Single track with 2,500' station sidings (1)	Double track (2)
• Sacramento to Merced	Triple track (3)	Four track (4)
• Tracy to Patterson	Single track with 2,500' station sidings (1)	Double track (2)
• Niles Junction to Pleasanton	Double track (6)	Four Track (7)
• Pleasanton to Livermore	Triple track (3)	Four Track (4)
• Livermore to Tracy	Double track (2)	Two double tracks (8)
• Tracy to Stockton	Double track (2)	Four Track (4)
• Newark to Niles Junction	Triple track (3)	Four track (4)
• Oakland to San Jose	Four track (Oakland (frt) /Niles (pass)) (2,2)	Four tr 1 (2, 2 w/OCS)
• San Francisco to San Jose	Three / Four track	Three / Four track
• San Jose to Salinas	Double track (2)	Same as Alt 1(2)
• Redwood Jct. to Newark	Single track with 2,500' station sidings (1)	Double track (2)
• Santa Cruz to Watsonville	Single track with 2,500' station sidings (1)	Same as Alt 1 (1)
• Castroville to Monterey	Single track with 2,500' station sidings (1)	Same as Alt 1 (1)
• Gilroy to Hollister	Single track with 2,500' station sidings (1)	Same as Alt 1 (1)
• BART Fremont to Martinez	Double track aerial structure w/ tunnel in Dublin (Iron Horse trail) (9)	

Engineered Corridors

Plan, profiles and typical sections have been developed for the following corridors;

- Benicia Bridge – high level replacement of existing bridge (not feasible)
- I-80 corridor - from Fairfield to Hercules including modifications in Vallejo (10, 11)
- Marin to Richmond – from San Quentin to the Richmond BART / Capitol Corridor station
- Oakland 4th track – from MacArthur Station to West Oakland
- Bay crossing - West Oakland Wye to Geary corridor
- Bay crossing - West Oakland Wye to the Presidio
- West Oakland Regional Rail
- Altamont corridor – from Tracy to Redwood City
- Livermore BART connection to Isabel Station

These corridors are described in detail in the sections below along with potential station locations and maintenance, servicing and layover facilities as appropriate.



Benicia Bridge – high level replacement of existing bridge (not feasible)

High level bridge alternatives for the Benicia Bridge were reviewed to eliminate the need to for bridge closures during ship passages along the navigation waterway. The vertical clearances for the navigation channel are a minimum of 138 feet. The starting point for this study is the existing Martinez Intermodal Station which is to remain in service.

Two alignments were tested for feasibility one as far east as possible without entering the wildlife area and to keep the strait crossing as short as possible and one sufficiently to the east to allow enough distance to achieve the height necessary for the strait vertical clearance without impacting the new I-680 facilities. See sheet MARTKEY. Both bridge alternatives are designed as two track facilities to carry both passenger trains and the UPRR freight traffic. The UPRR track and bridge design criteria would govern under this assumption.

The shorter crossing alignment shown on MART2 would require raising the new I-680 highway lanes by 22' in order to achieve the clearances over the shipping channel in Suisun Bay. This was deemed an unacceptable solution to the highway issue. The resulting structure for this solution was over 9 km long. The track tie-in on the Benicia side was to the lower UPRR track leading to the automobile loading facility to avoid the impact to the industrial buildings to the west if trying to tie into the higher UPRR leading to the existing Benicia Bridge.

The longer alignment shown on MART1 meets all the design criteria but significantly impacts the Edith State Wildlife Area near the Concord naval weapons station. The resulting structure for this solution was over 10 km long. The track tie-in on the Benicia side was to the common tracks before the UPRR splits into the upper and lower tracks. This requires crossing the wetlands on the Benicia side for over 2 km on either structure or at-grade embankment.

Neither of these alternatives was deemed a feasible solution due to the impacts to the I-680 highway or the wildlife and wetland areas. No conceptual structural design was developed for this crossing.

DATE	REVISION



SHEET MARTKEY
DATE 03-01-07
GRAPHIC SCALE 1" = 2000'



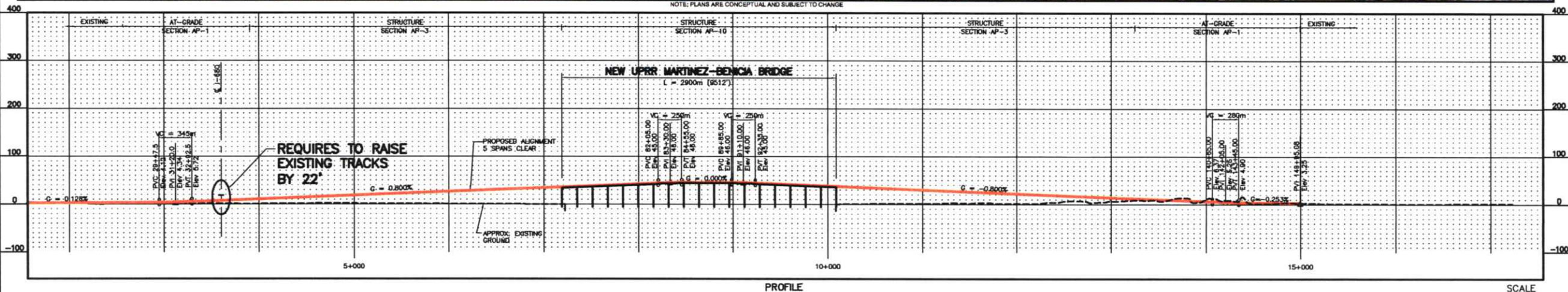
PLAN

SCALE
HORIZ: 1" = 2000'
VERT: 1" = 4000'

**BAY AREA - SACRAMENTO
UPRR RE-ALIGNMENT
MARTINEZ-BENICIA**



CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



BAY AREA - SACRAMENTO

UPRR RE-ALIGNMENT

MARTINEZ-BENICIA

DATE: 03-01-07

REVISION:

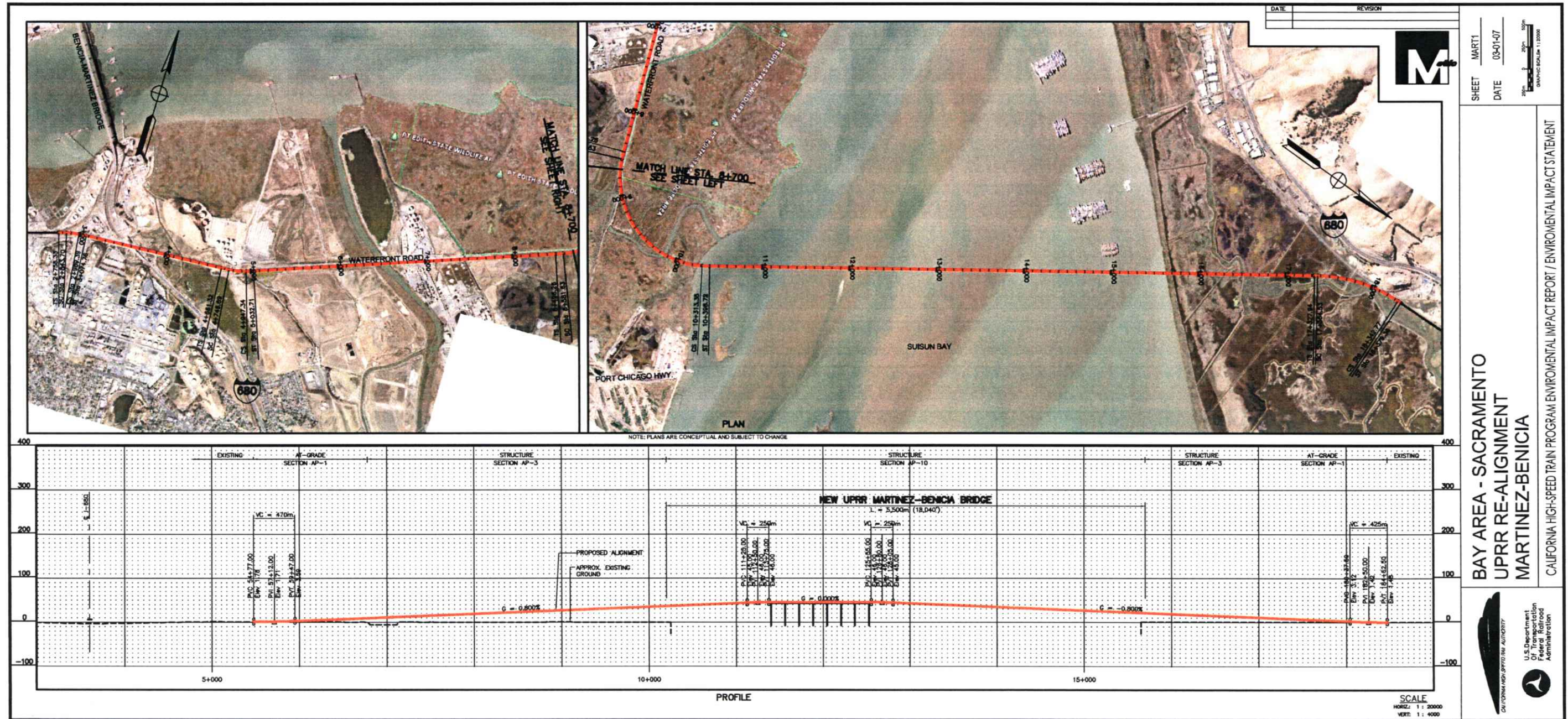
SHEET: MARTZ

DATE: 03-01-07

GRAPHIC SCALE: 1" = 1000'

U.S. Department of Transportation
Federal Highway Administration

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



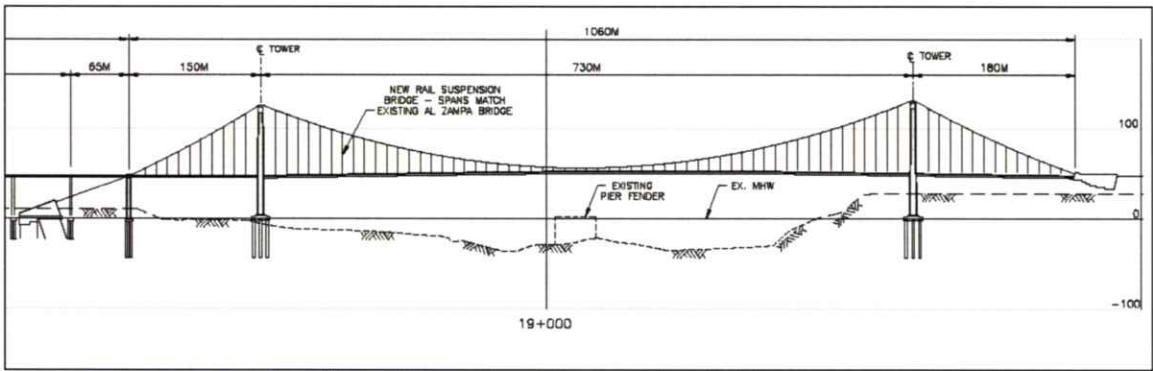
I-80 corridor - from Fairfield to Hercules.

This alignment was developed in accordance with Study Alternative 2, for non-compliant service; and potentially electrified. Several alignments were developed for either side of the new Carquinez Bridge. The beginning for the study corridor is the existing Hercules Capitol Corridor Station in Hercules and the end point is the existing station in Suisun beneath highway 12.

The selected alignment is shown on VAL81, 82 and 83. The alignment starts at the Hercules station as a two track section separate from the two freight tracks and continues in an at-grade section to the median of I-80 where it transitions to an aerial structure configuration. It continuous in this manner to the Carquinez Bridge. As a future improvement a side running at-grade solution should be investigated for a portion of this section. The new rail bridge has been designed to fit in the space vacated by the recently demolished highway bridge. The spans match the new bridge recently completed. See the attached conceptual structural design. The alignment continues in a low aerial configuration in the median to a Redwood Street Station. The Station was located to intercept automobile traffic from Highway 37. After crossing the I-80 / 37 interchange the rail alignment continues in the highway median in an at-grade configuration to Cordelia where it rejoins the existing UP railroad alignment. A potential Station has been shown at Cordelia Road to intercept local traffic along with Suisun Valley Road traffic. The line continues along the existing rail corridor with separate tracks from the existing industrial leads to the existing Capitol Corridor Station at Suisun.

Structure concept

The concept for the rail crossing of the Carquinez Straits is the same as that for the newly constructed (2004) crossing that replaced the old steel truss bridge. The main crossing would be a suspension bridge that parallels the existing bridge with spans that closely match that bridge. The main span would be 730-meters with side spans of 150-meters and 180-meters. The suspension bridge would have concrete towers 120-meters in height.



Elevation of Carquinez Suspension Bridge Concept

The west approach structure, 547-meters in length, would likely be precast post-tensioned segmental concrete construction. The total length of the approaches and suspension bridge would be 1607-meters.

In 2000 the new Carquinez Bridge winning bid came in at a cost of \$6,500 per square meter. Escalating these costs to 2007 dollars results in a cost per square meter of \$7,600 per square meter. To be consistent between bridges and based upon other data from other bridges we have used a cost per meter for the suspension span of \$7,750 / m², which for this bridge equates to a cost of \$99,200,000 per kilometer.

Based upon cost data that we have for high level approaches constructed of segmental concrete we have used a cost per square meter for the approaches of \$5,000 / m² or \$64,000,000 per kilometer.

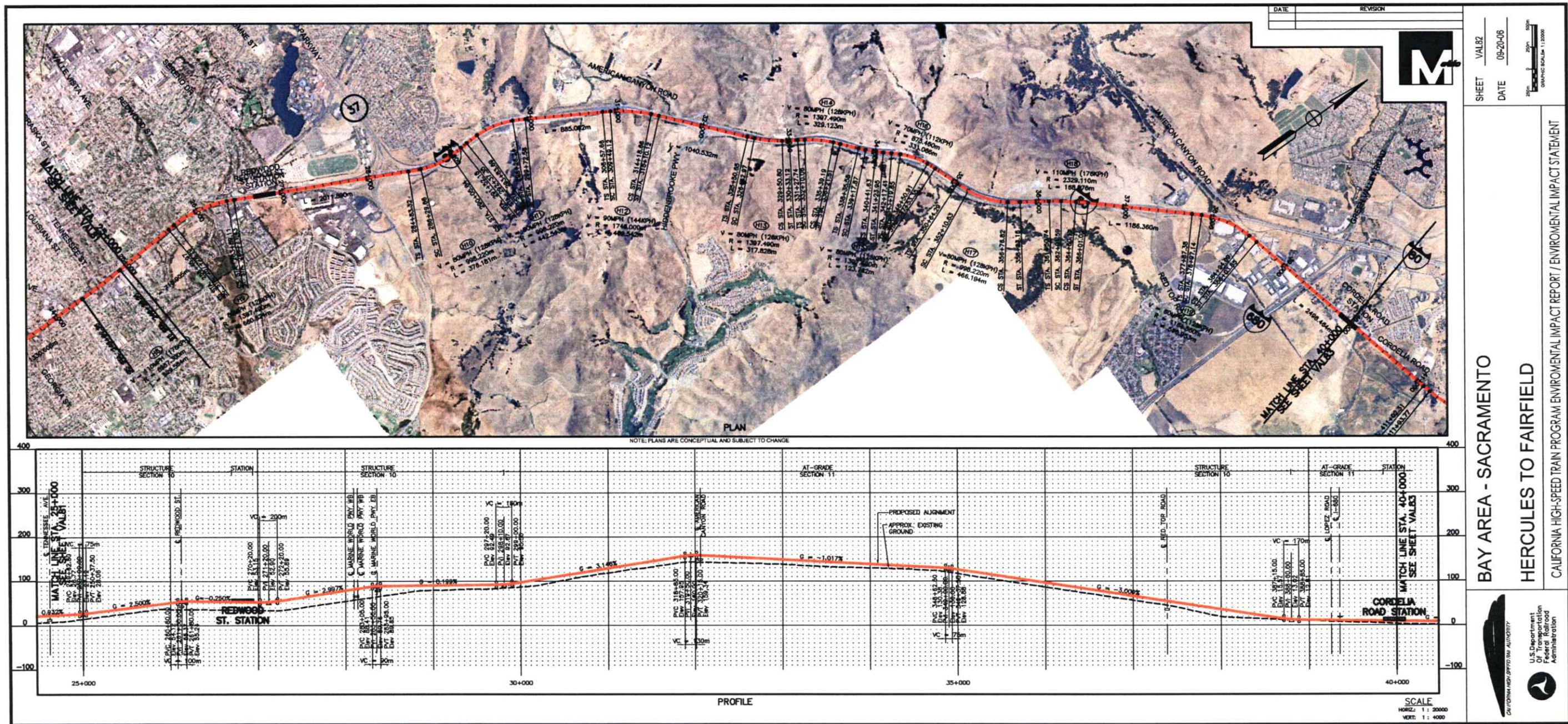
Using these costs per square meter results in a construction cost of \$140.2 million. In addition, we have added an environmental mitigation contingency of 5% to this cost. To this should be added 7% for engineering to prepare P,S&E, as well as 12% for construction management. At this conceptual stage we recommend a contingency of 35% be added to these costs. The resulting estimated project cost for the Carquinez strait rail crossing is \$223 million.

Alignment Variations

An alignment variation between Hercules and the Carquinez Bridge shown on VAL81b was to stay in the existing rail corridor for another 4 km. This requires a four track solution from the Hercules Station to the diverge point. The alignment then climbs over and through the hills utilizing aerial structure and tunnel to re-enter the I-80 median and to the proposed new rail Bridge over the strait. This alignment was deemed less cost effective than the alignment described above.

An alignment variation between the Carquinez Bridge and Cordelia is shown on VALL1, 2 and 3 and was to serve downtown Vallejo and stay within the existing railroad right-of-way. Stations were shown at Solano Avenue, Broadway Street / Marine World and at Cordelia Road. The existing right-of-way through Vallejo is fairly narrow and surrounded by residential homes and/or the local streets. The alignment would be on aerial structure from the I-80 median and down the center of Sonoma Boulevard to the Solano Avenue Station. It would continue in the widened existing railroad right-of-way to a Station at highway 37 and Marine World amusement park. The alignment would continue along the existing railroad through Jamison canyon to the Cordelia Station. The industrial leads in Cordelia and Suisun would need to be maintained. This alignment variation was deemed too disruptive in Vallejo and was dropped from further consideration.

Two more variations in Vallejo were considered as part of the variation described above. Both of these were developed to see whether a good ferry connection could be designed. These variations are shown on VALL2B and 2C. The alignment shown on 2B served the existing ferry terminal and 2B served a relocated ferry terminal at Derr Street. Vallejo has determined not to relocate the ferry terminal thereby eliminating 2c and 2b would be very disruptive to downtown Vallejo and was dropped from further consideration.



DATE	REVISION
09-20-08	VALB2

U.S. Department of Transportation
Federal Railroad Administration

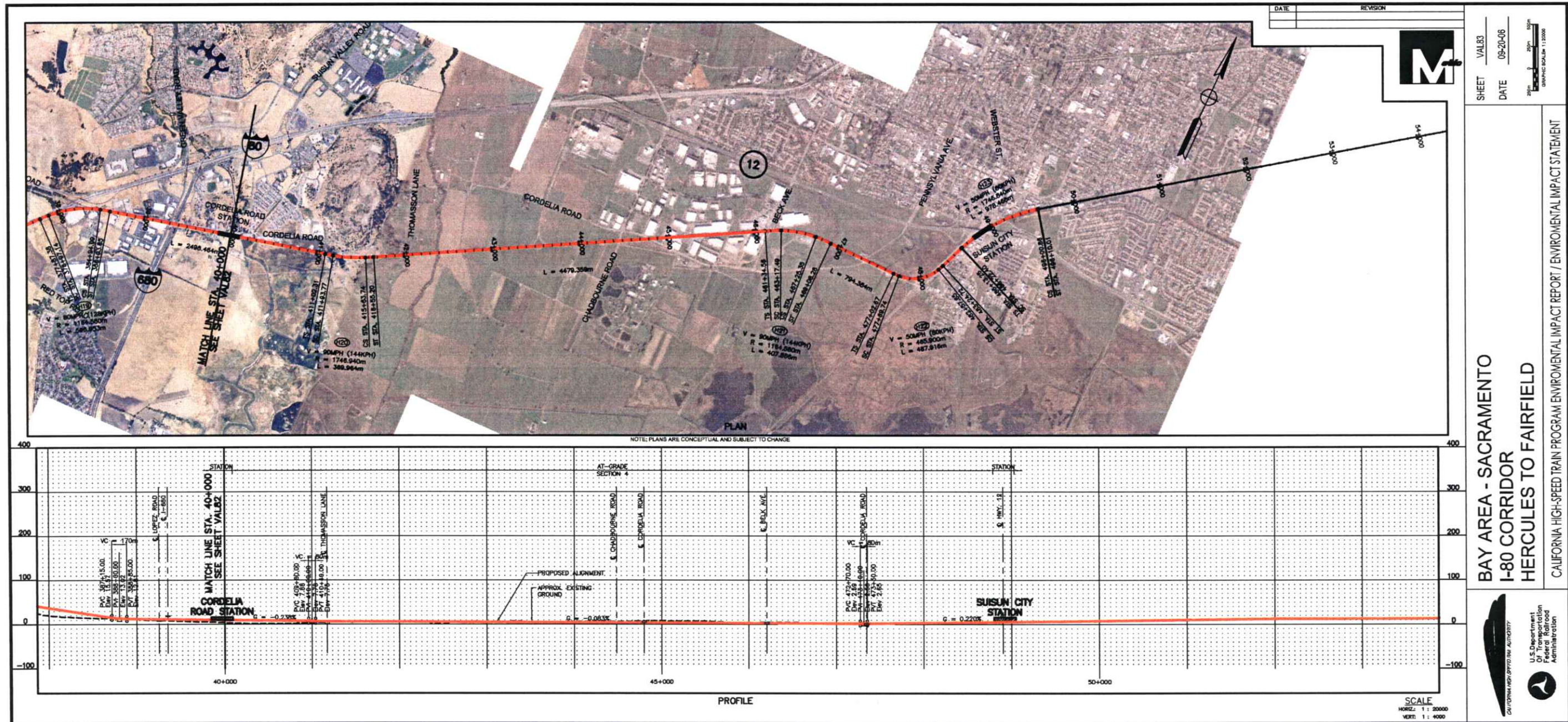
BAY AREA - SACRAMENTO

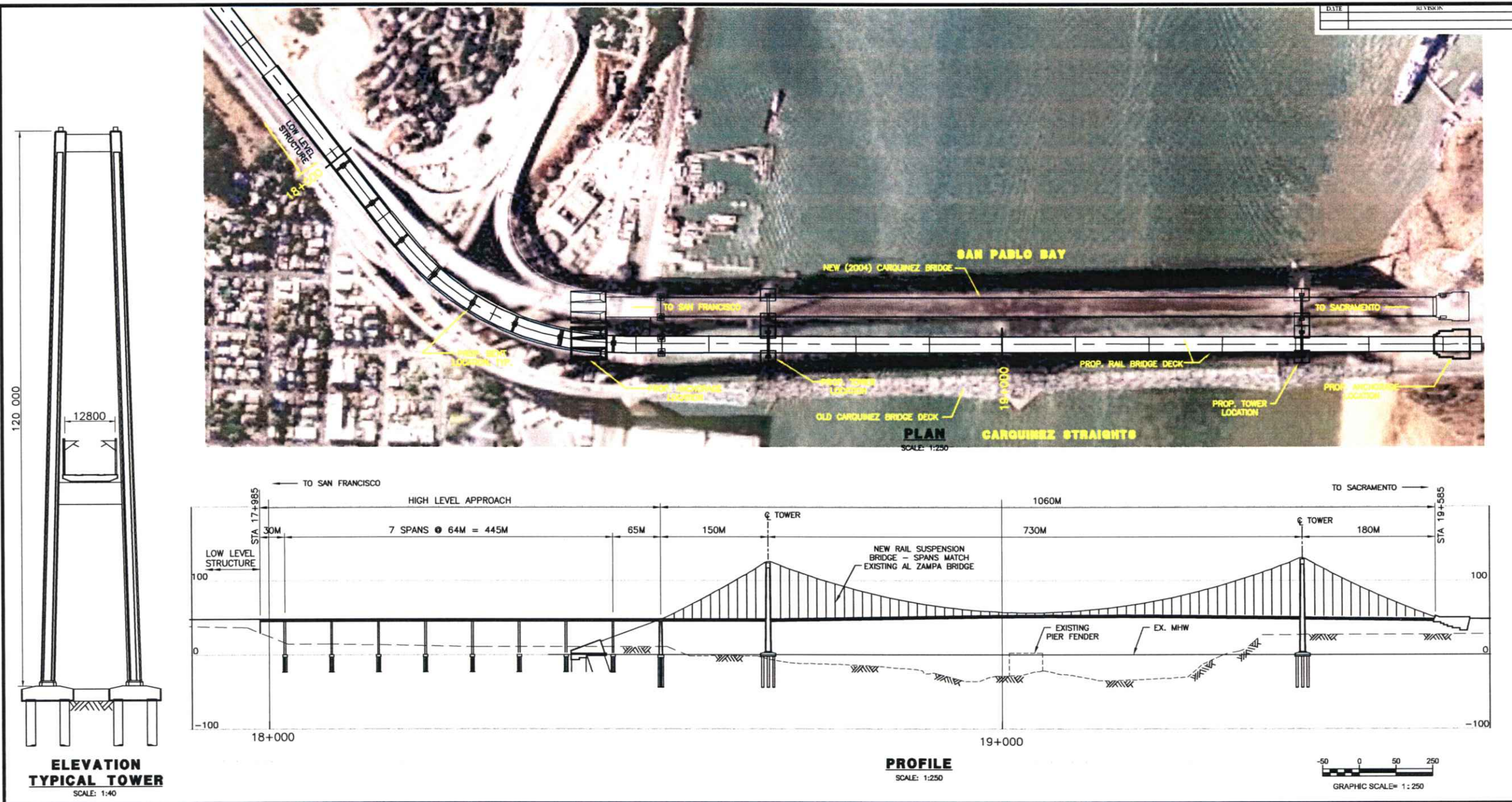
HERCULES TO FAIRFIELD

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

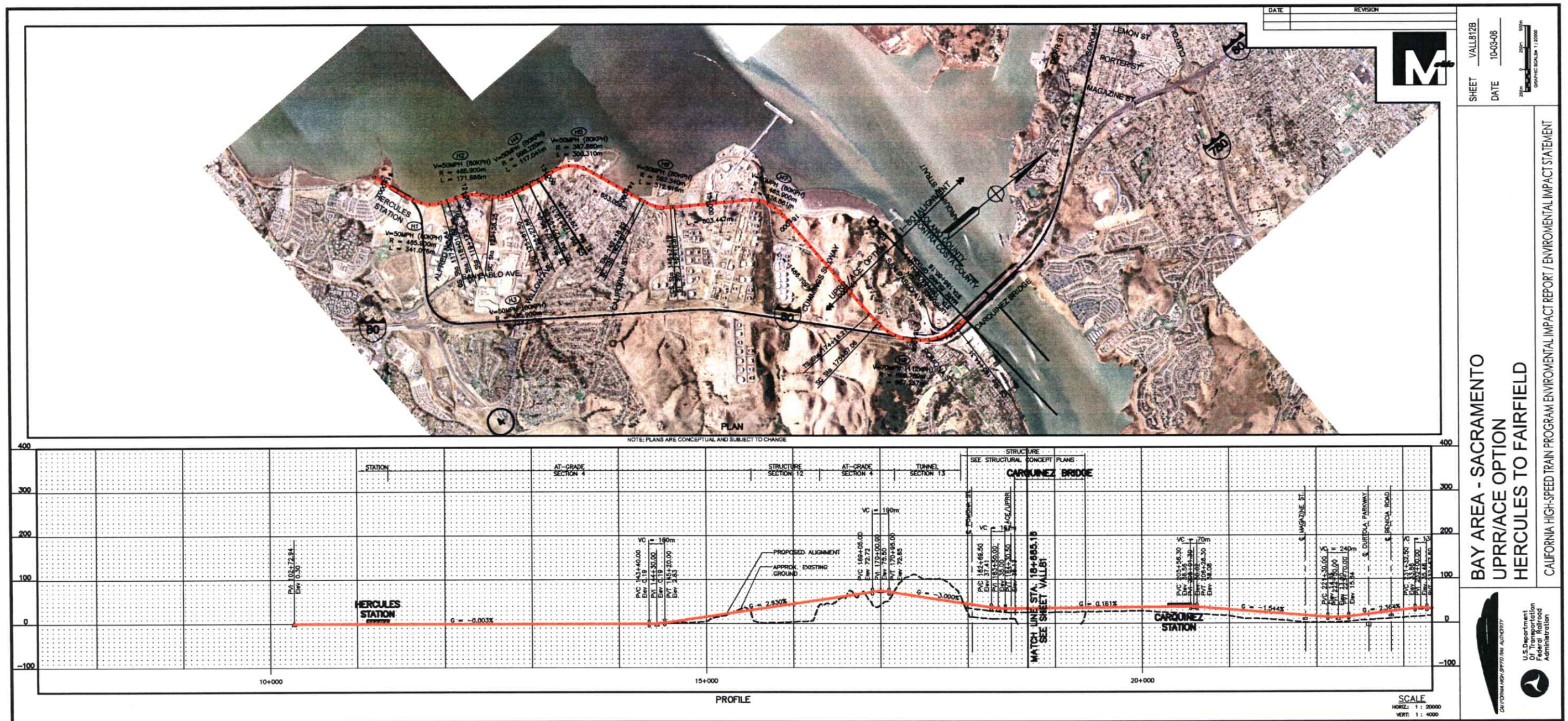
SHEET VALB2

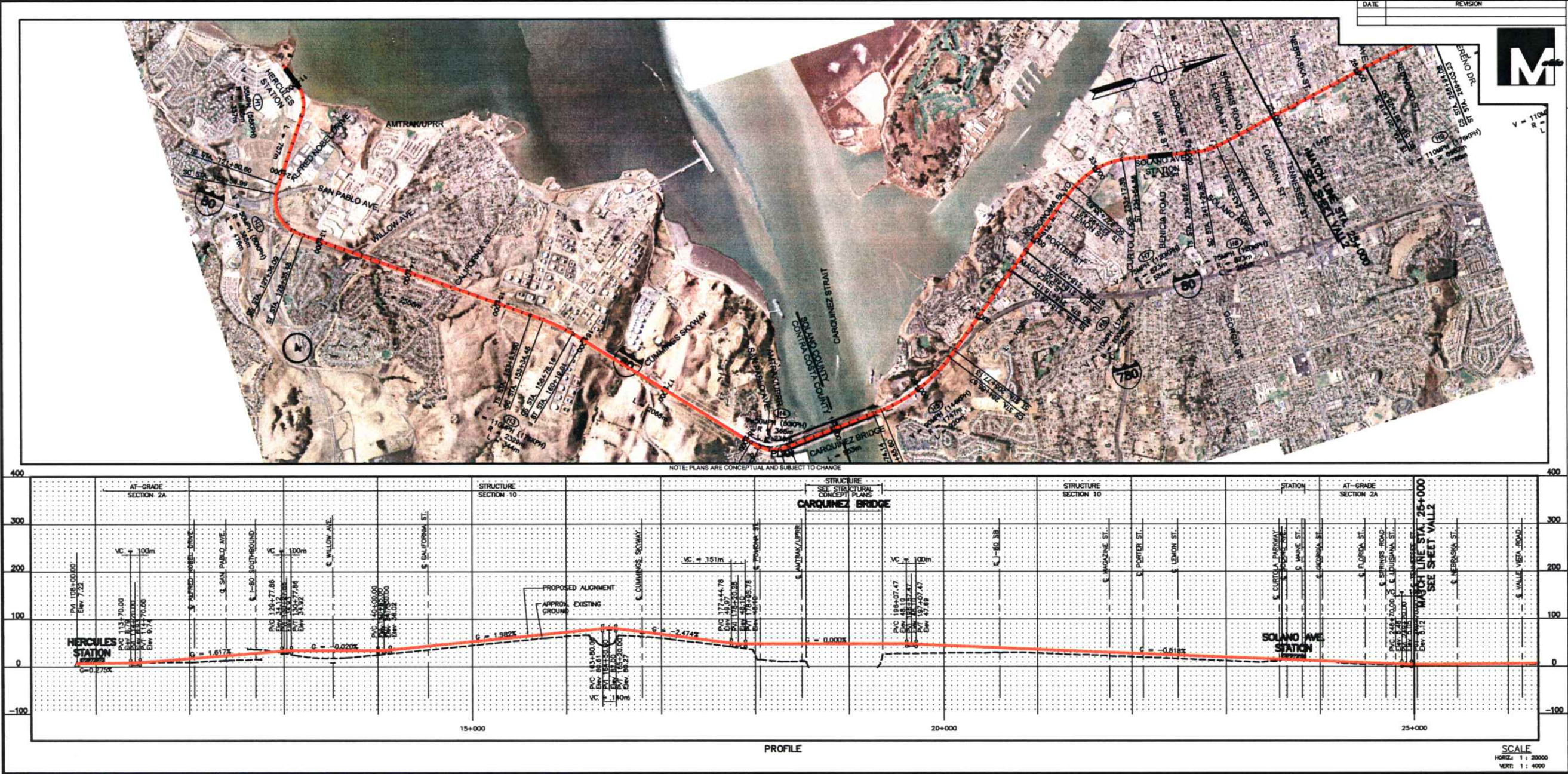
DATE 09-20-08





BAY AREA - SACRAMENTO I-80 CORRIDOR HERCULES TO FAIRFIELD	
CARQUINEZ RAIL BRIDGE CONCEPTUAL DESIGN	
SHEET VAL81	DATE 2-6-07
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT	
 	





SHEET

VALL1

DATE

01-15-07

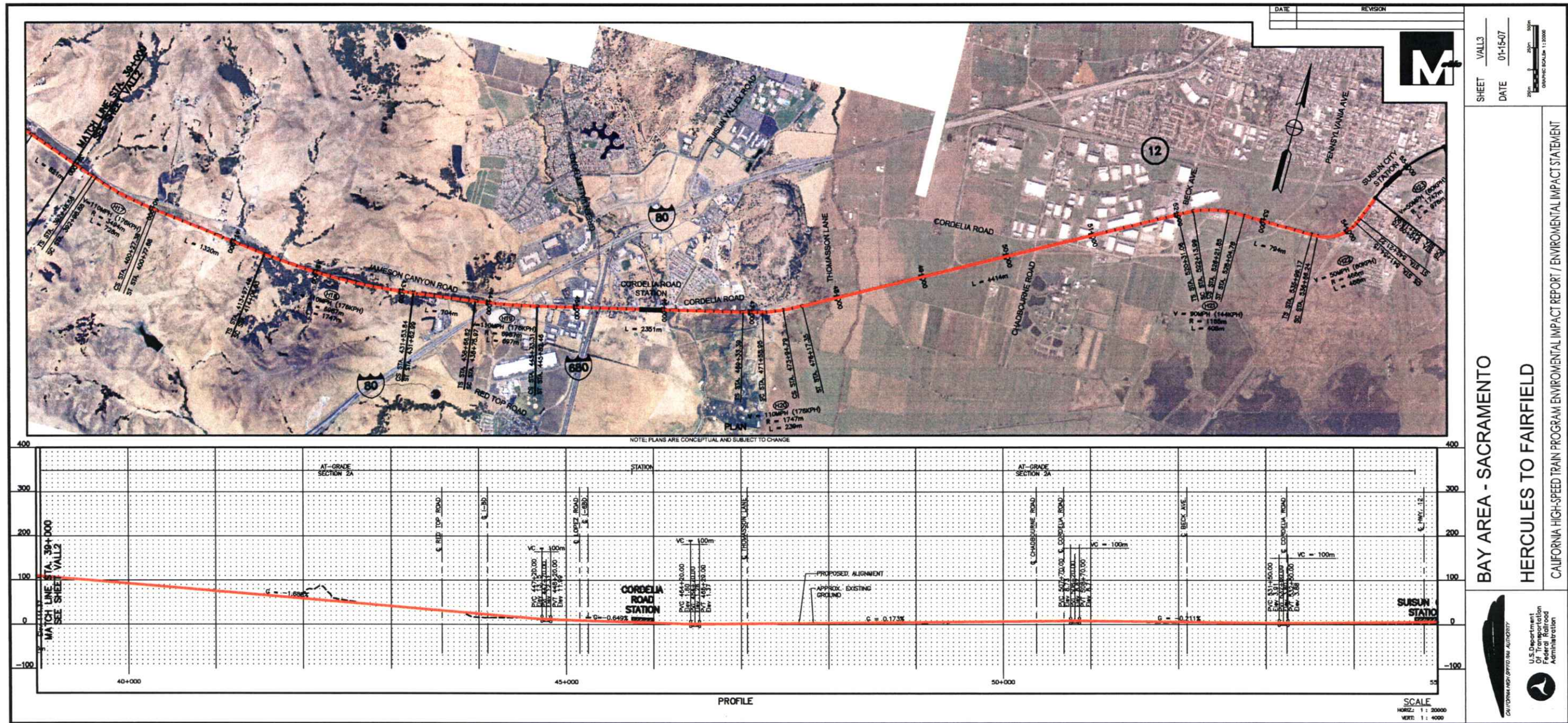
U.S. Department of Transportation
California High-Speed Rail
Administration

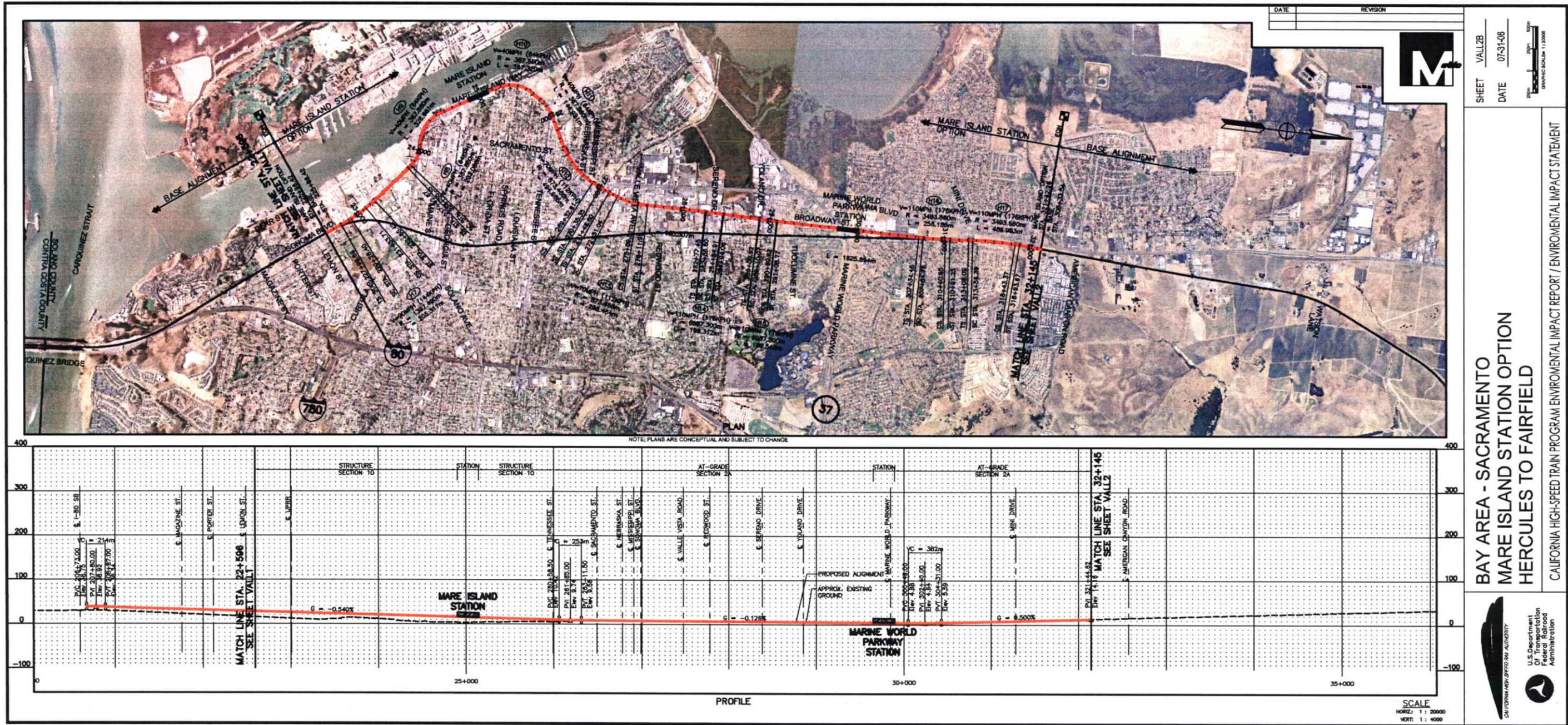
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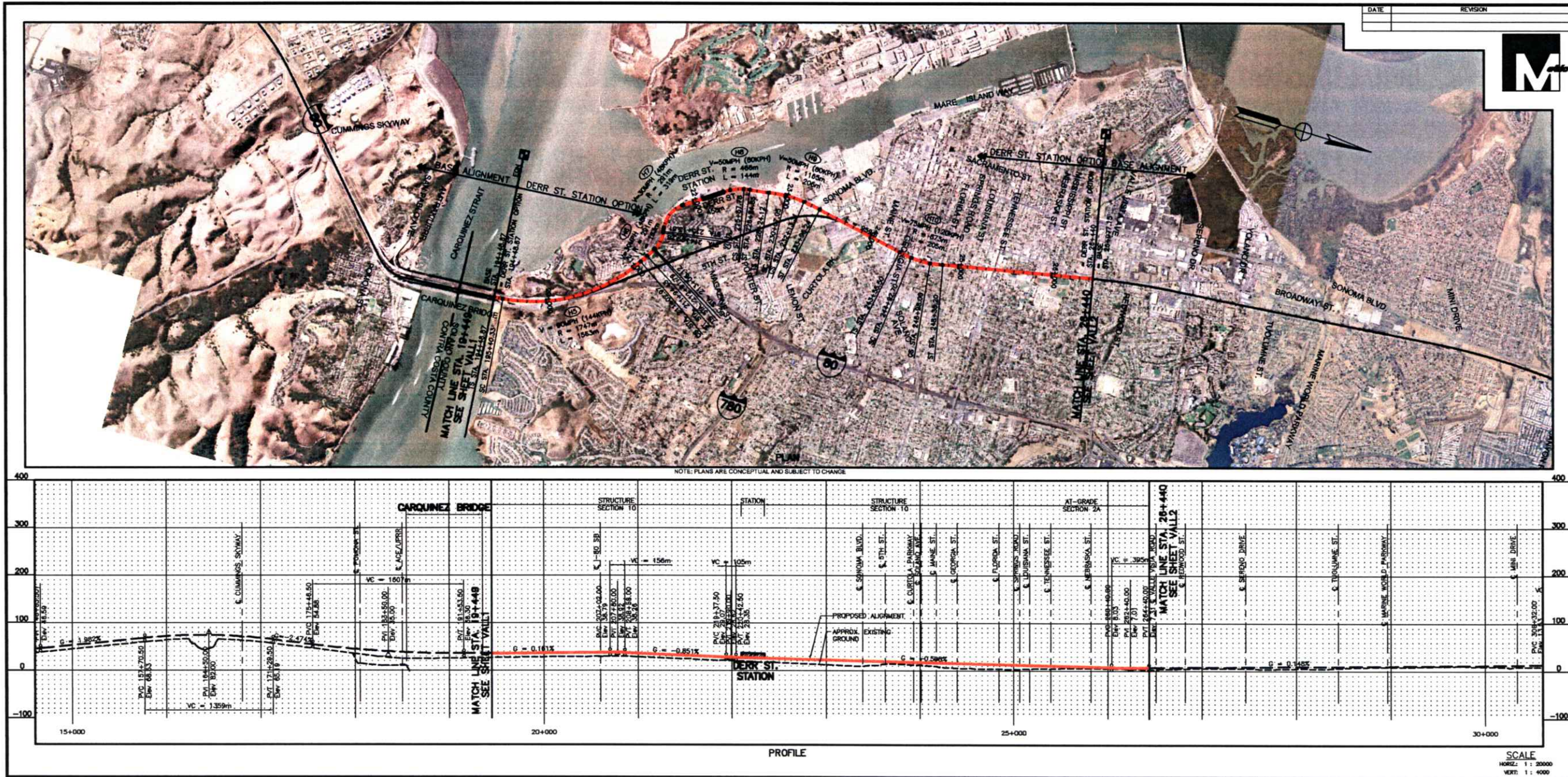
HERCULES TO FAIRFIELD

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

Page 14







DATE	REVISION



SHEET

VALL2C

DATE

07-31-08

BAY AREA - SACRAMENTO

DERR ST. STATION OPTION

HERCULES TO FAIRFIELD

U.S. Department of Transportation
Federal Highway Administration

CALIFORNIA HIGH-SPEED TRAIN PROGRAM

ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

Marin to Richmond – from San Quentin to the Richmond BART / Capitol Corridor station

This alignment is a continuation of the SMART corridor alignment option along Anderson Drive to a new San Quentin ferry terminal. The alignment would be as designed by SMART to the proposed ferry terminal and then continue across the Bay to the Richmond BART and Capitol Corridor Station. A conceptual structural design has been prepared for the Bay crossing. See technical memorandum 4j for a conceptual layout of the Richmond connectivity station.

The alignment is on aerial structure along Anderson Drive going between the water treatment facility and I-580 to the ferry terminal station. The alignment continues on structure as depicted on the structural conceptual design. The Richmond – San Rafael bay crossing consists of several bridges, which when taken together are 6584-meters in length.

Starting at the west side of the bay the structure would consist of a fairly low level structure for the first 1.44 km of the crossing. This structure is proposed as a precast concrete segmental concrete construction over water, with moderate span lengths on the order of 90-meters.

The second portion of the crossing consists of the 1.25 km climb up to the primary navigation channel at a 3% grade and would likely consist of precast, or possibly cast-in-place, segmental concrete construction. Spans have for concept design been set at 125-meters. This structure rises to about 60-meters above the water level.

The crossing of the existing 326-meter primary navigation will require a high level long span structure. We propose to make this crossing with a cable-stayed bridge. The main span would be on the order of 326-meters, with side spans of 163-meters. Matching the existing highway bridge the cable-stayed structure clear the channel by 56-meters.

To the east of the primary navigation channel by 1.5 km is a second navigation channel. This second channel will also be spanned with a cable-stayed structure. Between these two channels we propose a cast-in-place segmental concrete structure of variable depth with spans of 180-meters. Total length of this transition structure is 900-meters.

The second cable stayed bridge is similar to the first in regards layout with the same span arrangements. The only difference being the towers will be somewhat shorter as the second channel does not have as high as clearance requirement as the primary channel.

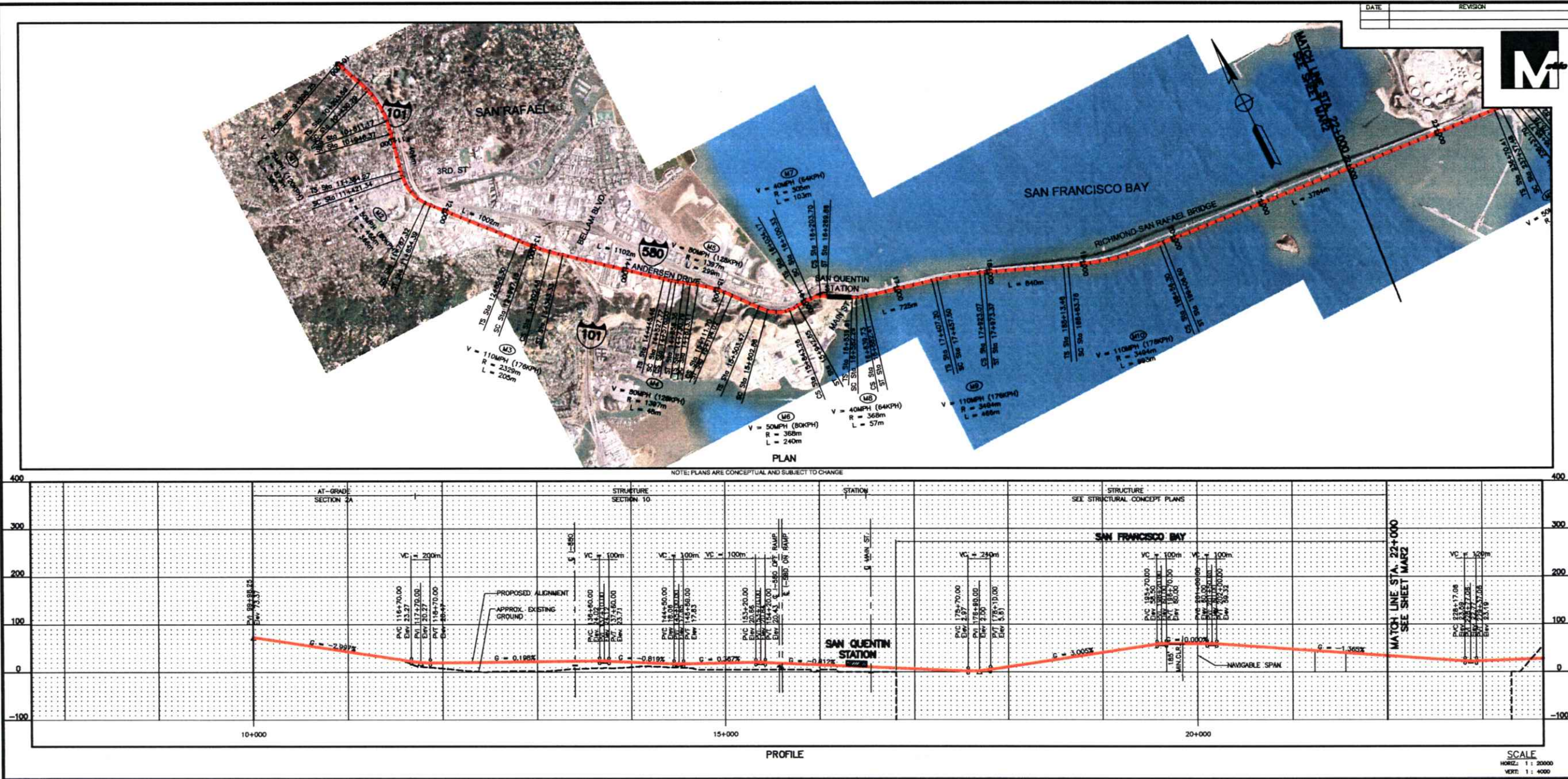
To the east of this second cable stay structure the structure slopes down to the east shore where it comes to grade. This 1.7 km structure is proposed to be precast post-tensioned concrete box viaduct of approximately 90-meter spans.

For cost purposes data from the bids of the new Carquinez highway bridge as well as the bid data for the Benicia Bridge were used. The Carquinez Bridge during type selection pitted a cable-stay alternative against the suspension span, and at that time the costs of the two bridge types proved to be similar. As a further data point we reviewed the estimated cost of the cable-stay span for the Gerald Desmond Bridge. All three of these had similar bid or estimated costs. When escalated to 2007 dollars a cost of \$7,750 per square meter (\$99,200,000/km) was used for the cable-stay and the long span cast-in-place segmental structure.

For the high level approaches (again using data from the Gerald Desmond Bridge) a cost of \$5,000 per square meter (\$64,000,000/km) was used. For the low level approaches on the west end a slightly lower cost of \$4,500 per square meter (\$54,000,000 per kilometer) was used.

These costs result in a construction cost of \$465 million. In addition a 10% environmental mitigation contingency has been added to the construction cost. To this we have added 7% as design costs for P, S & E; 12% for construction management and 35% contingencies. The result is an estimated cost for the Richmond – San Rafael Rail crossing of \$763.5 million.

East of the new bridge the alignment continues in a retained cut and on aerial structure in the I-580 right-of-way and crosses over the BNSF rail facilities into the old rail corridor parallel to Ohio Avenue. It turns sharply to the north to the existing BART / Capitol Corridor Station, utilizing the same platform as the Capitols. The station is as shown in technical memorandum 4j, Connectivity Plan.



BAY AREA - SACRAMENTO

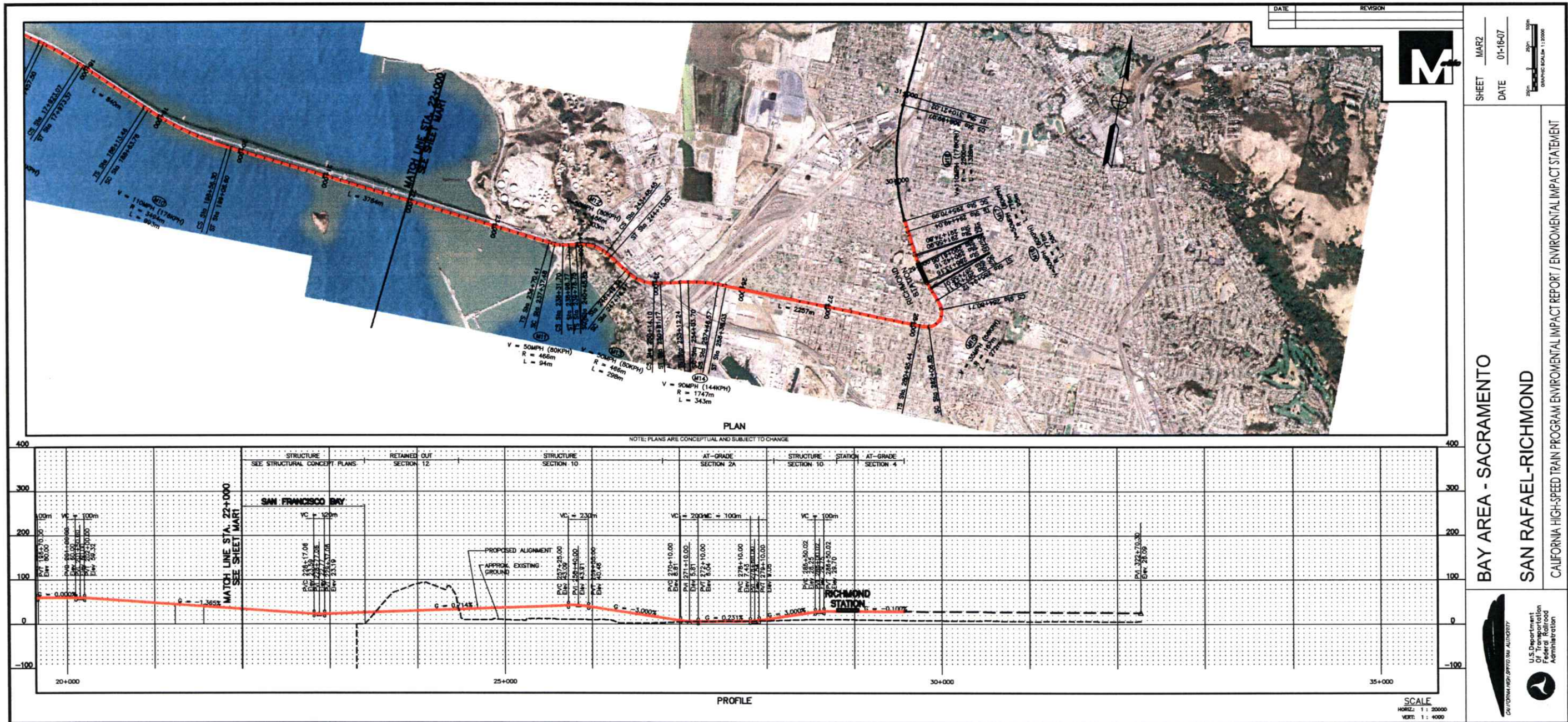
SAN RAFAEL-RICHMOND

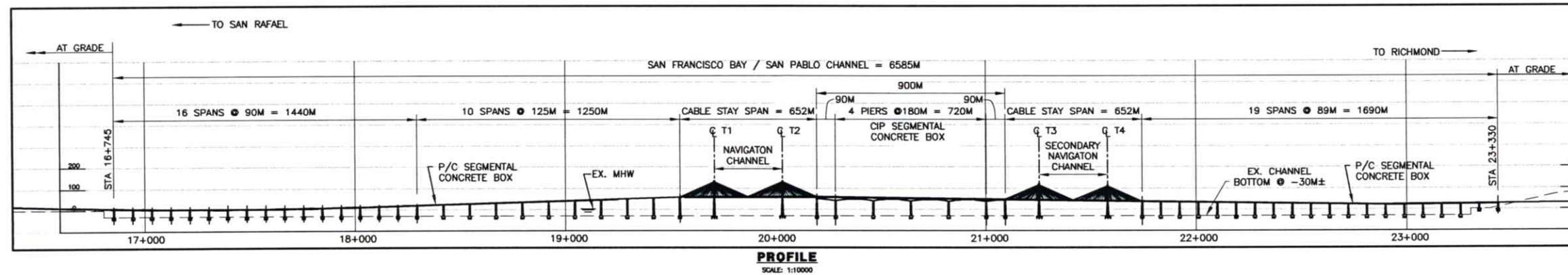
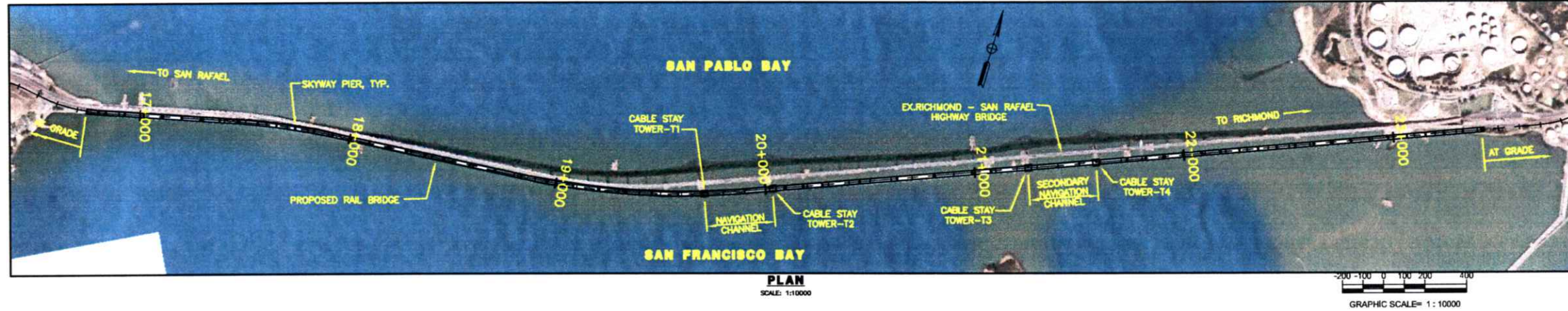
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

SHEET **MAR1**

DATE **03-22-07**

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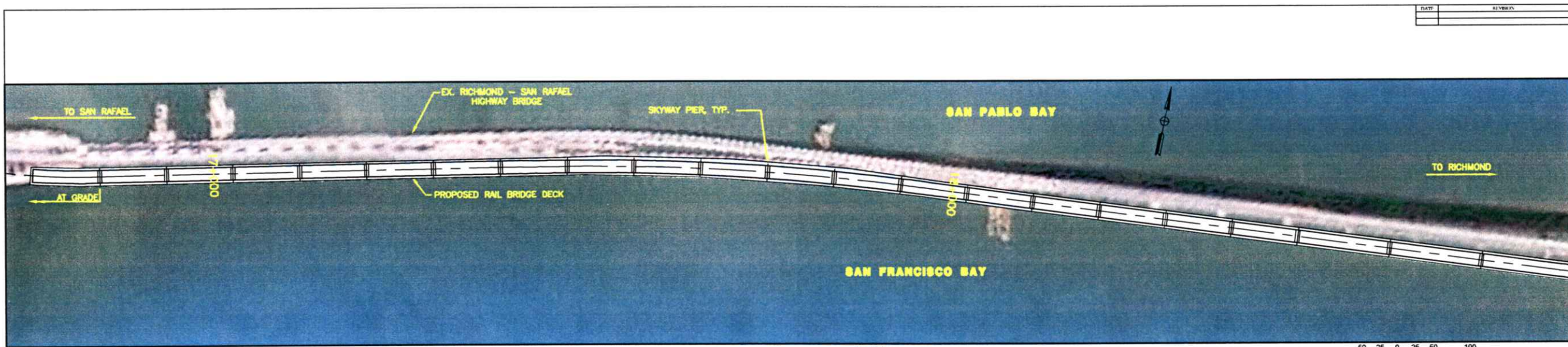


BAY AREA - SACRAMENTO
SAN RAFAEL-RICHMOND RAIL BRIDGE
CONCEPTUAL DESIGN

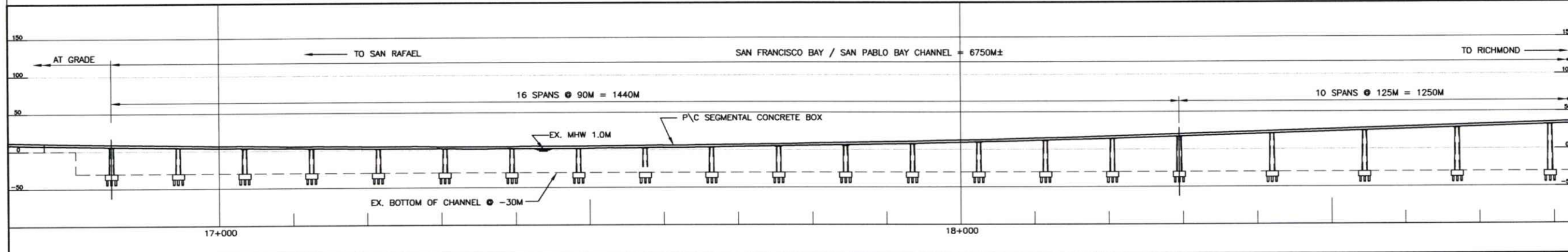
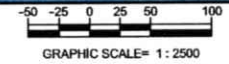
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SHEET MARI
DATE 2-6-07



PLAN
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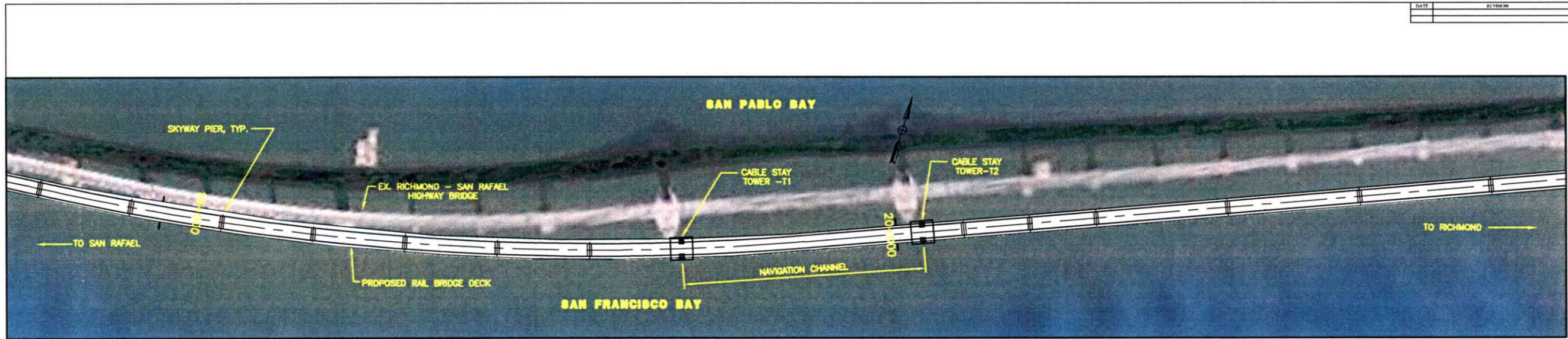
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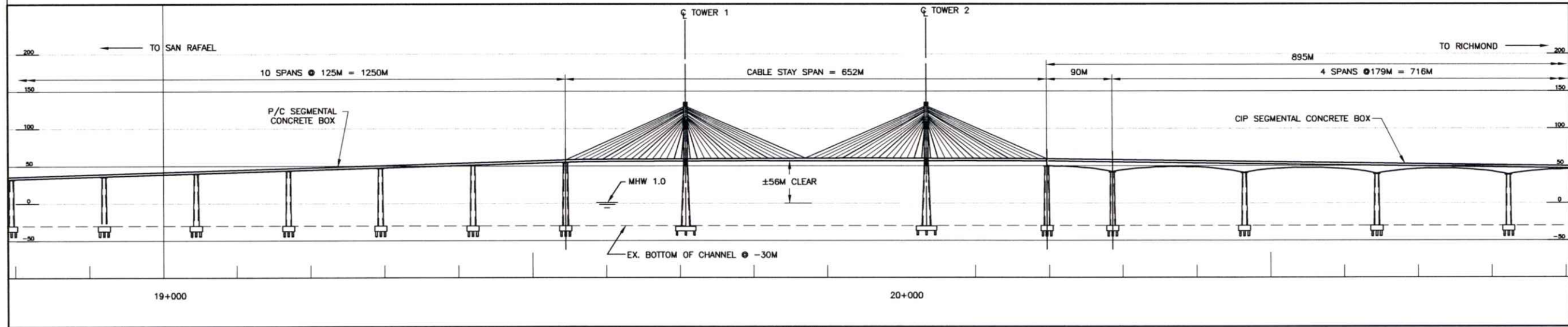
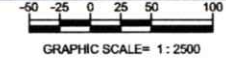
**BAY AREA - SACRAMENTO
SAN RAFAEL-RICHMOND RAIL BRIDGE
CONCEPTUAL DESIGN**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT





PLAN
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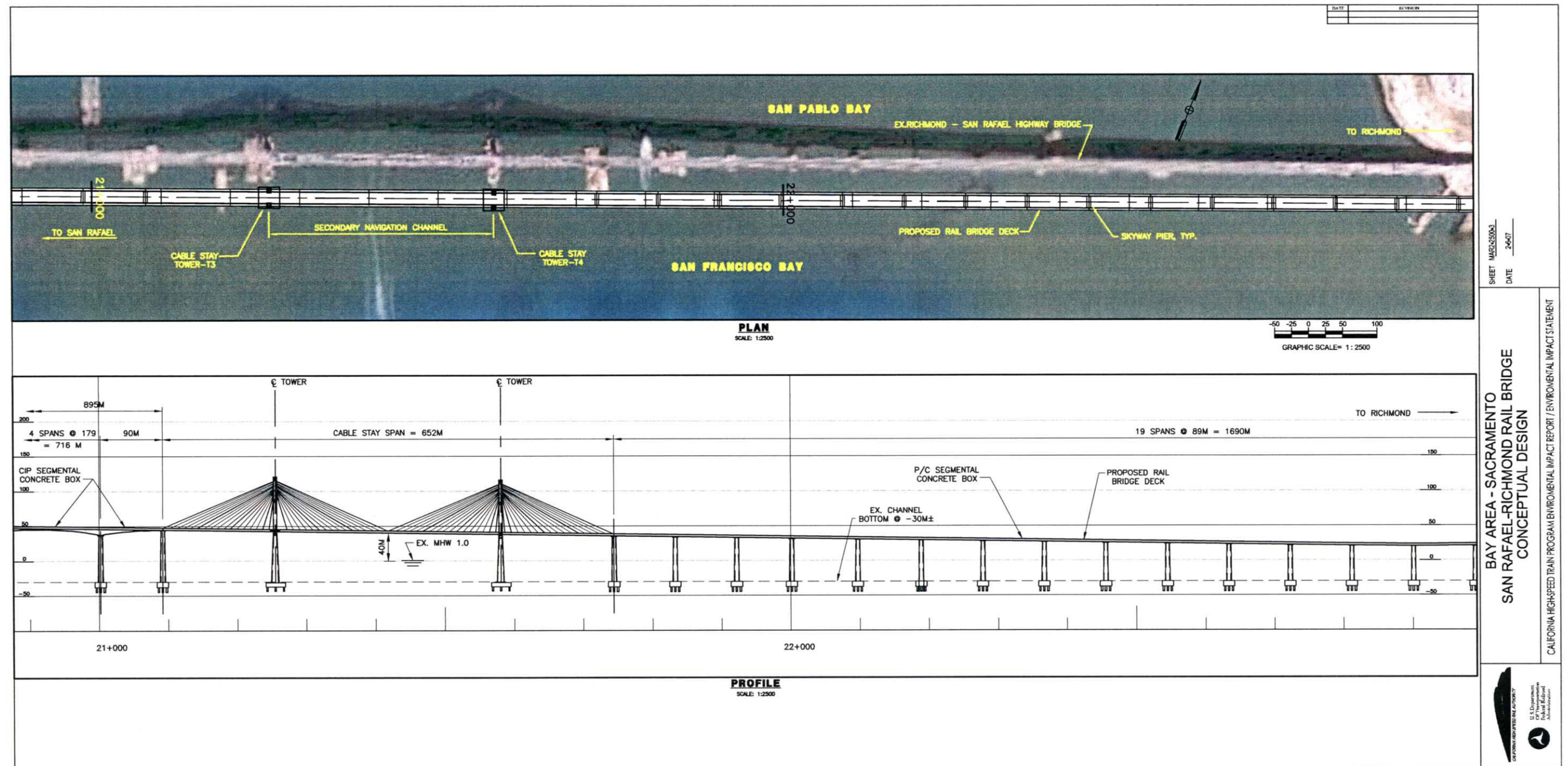
PROFILE
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DATE 2-5-07

**BAY AREA - SACRAMENTO
SAN RAFAEL-RICHMOND RAIL BRIDGE
CONCEPTUAL DESIGN**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



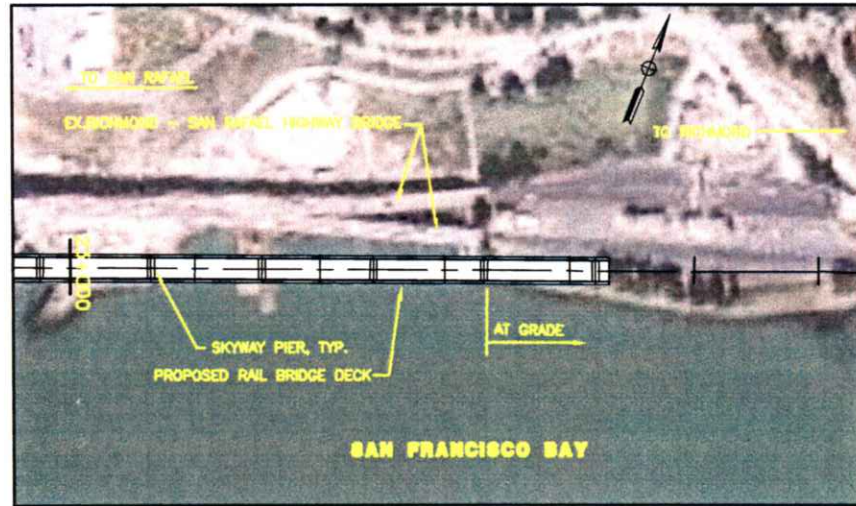


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DATE 2-4-07

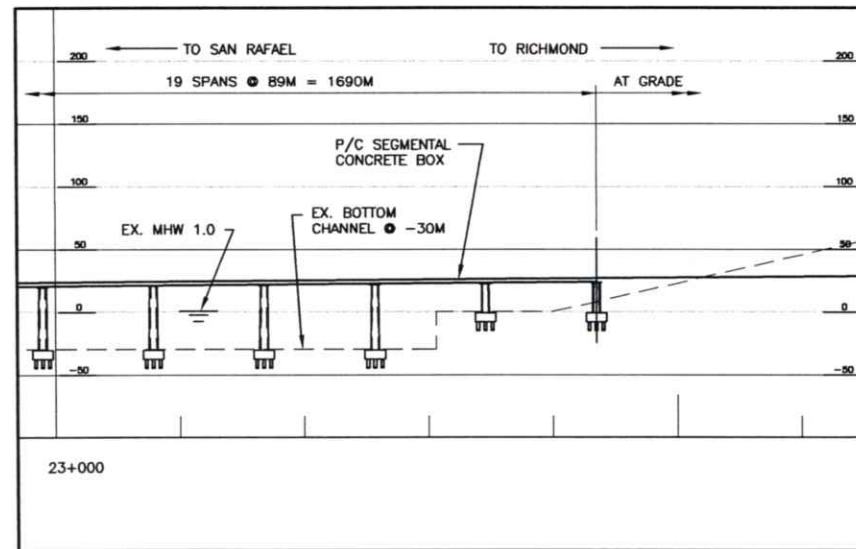
**BAY AREA - SACRAMENTO
SAN RAFAEL-RICHMOND RAIL BRIDGE
CONCEPTUAL DESIGN**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

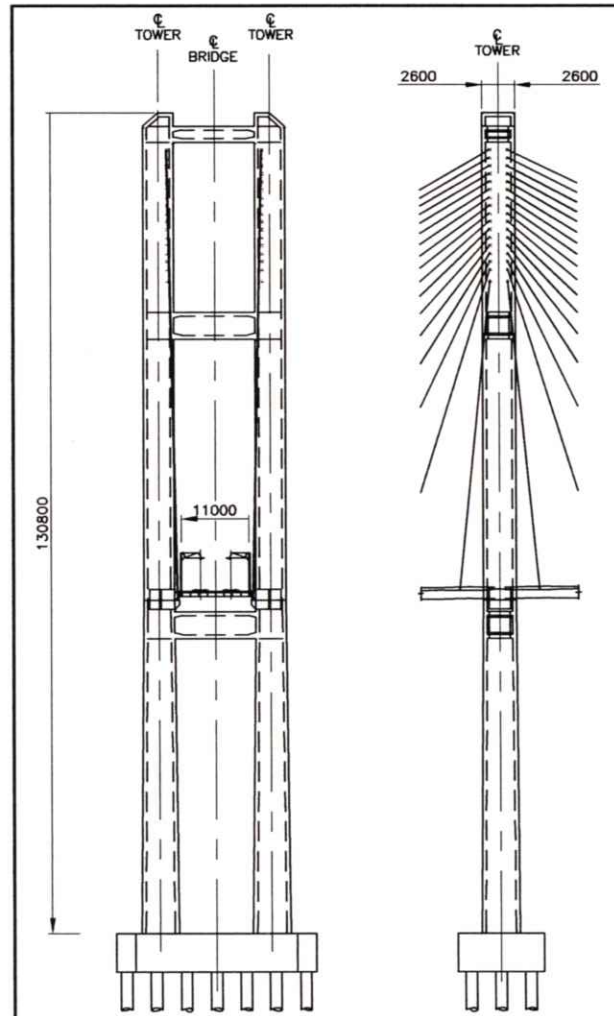




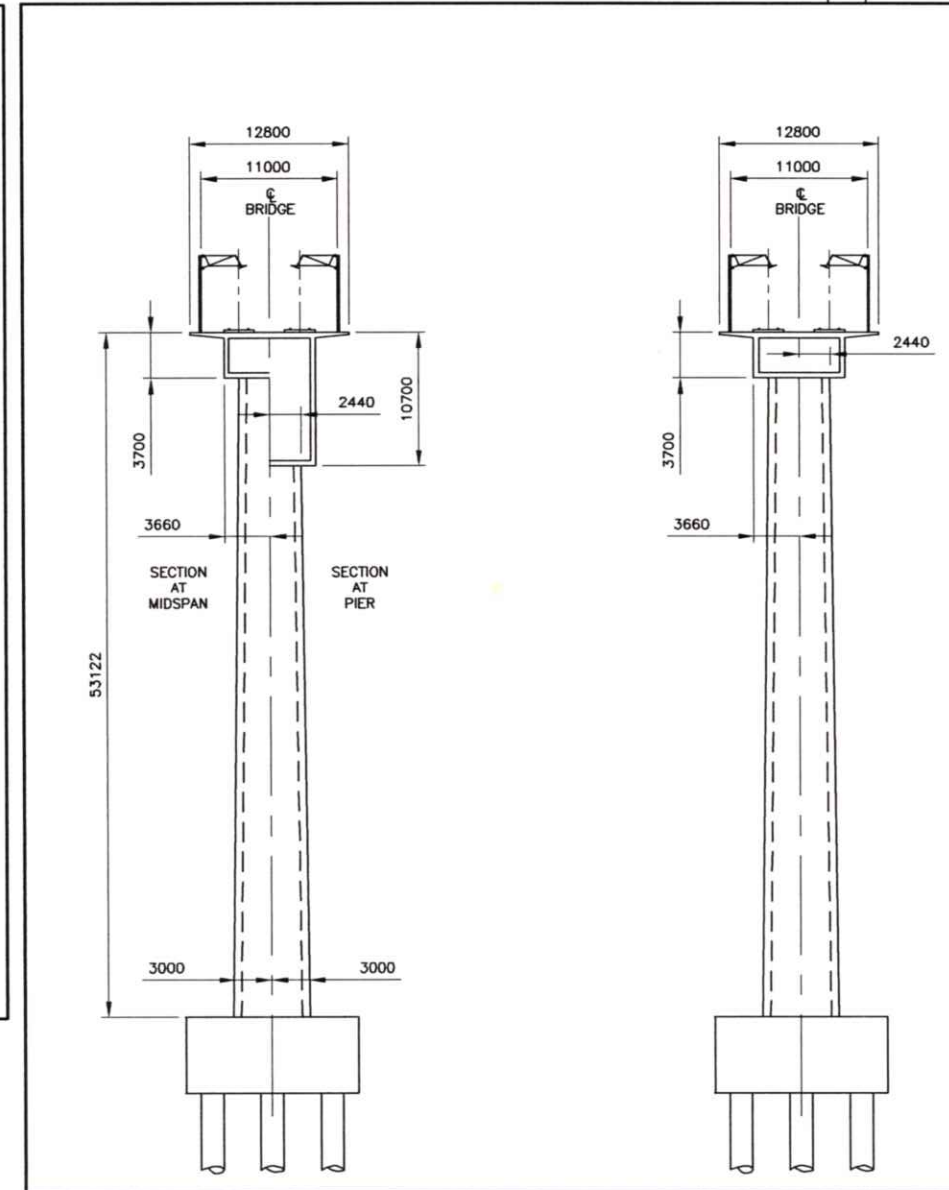
PLAN
SCALE: 1:2500



PROFILE
SCALE: 1:2500



TOWER SECTION T2
OTHERS SIMILAR
SCALE: 1:1000



TYPICAL SECTION
VARIABLE DEPTH SKYWAY
(CIP SEGMENTAL BOX)
SCALE: 1:500

TYPICAL SECTION
CONSTANT DEPTH SKYWAY
(P/C SEGMENTAL BOX)
SCALE: 1:500

BAY AREA - SACRAMENTO
SAN RAFAEL-RICHMOND RAIL BRIDGE
CONCEPTUAL DESIGN

SHEET MAR2004
DATE 2/6/07

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



Oakland 4th track – from MacArthur Station to West Oakland

Currently there are three tracks through downtown Oakland in the subway section and the 12th and 19th Street Stations. The MacArthur Station to the east is a four track facility and become three tracks before they enter the subway section. They remain three tracks through the wye and leave the subway section as three tracks near Washington and 5th Street. The tracks then join into two before they proceed on to the aerial structure near Jefferson Street. The West Oakland Station to the west of the track juncture is a two track aerial station.

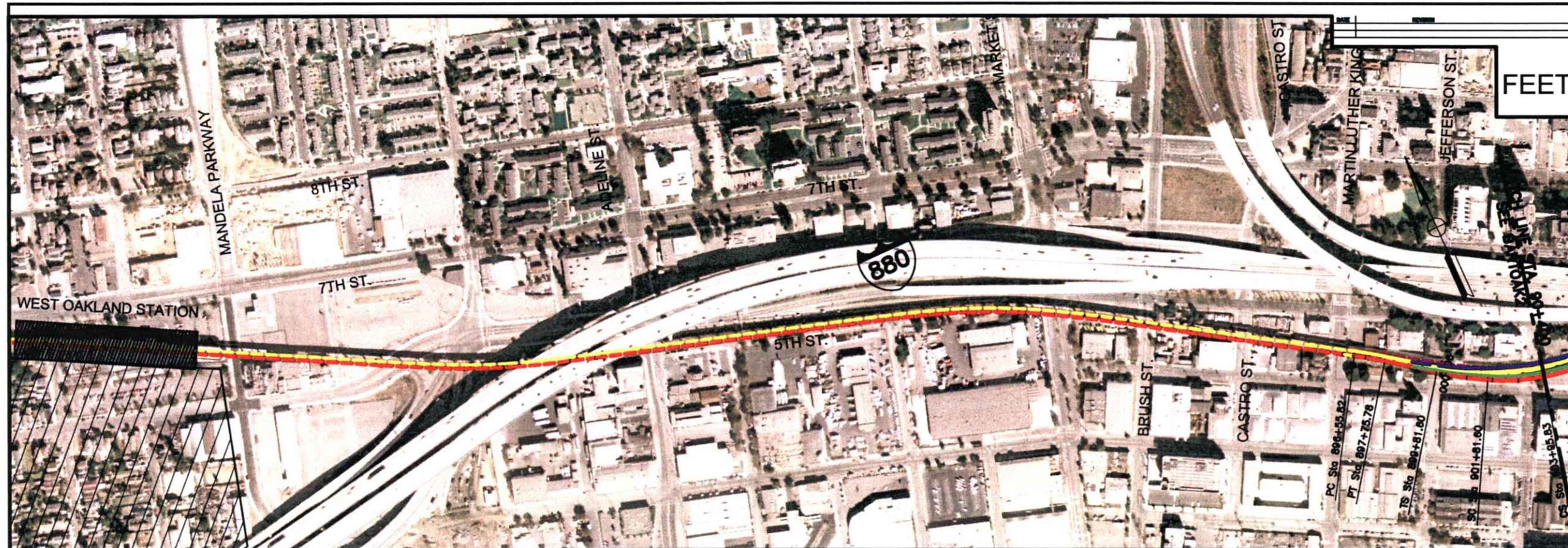
A fourth track was reviewed for a potential change in service for the existing system and / or when a new bay crossing needs to be constructed from Oakland to San Francisco. The connection to a new Bay Crossing at the Oakland Wye is discussed in the next section. The 4th track will allow cross platform transfer for all possible passenger connection options at either the 12th Street Station, the 19th Street Station or the MacArthur Station. This will become very essential when the new Bay crossing is operational.

The modifications necessary to achieve the 4th track through downtown Oakland is to extend the Richmond to Fremont track from MacArthur to the existing lower track. This requires a new tunnel portion to be built from approximately 29th street to the 19th Street Station. Pittsburgh to San Francisco track will connect to the western upper level track. This can be accomplished with the existing track alignment. The Fremont to Richmond service would continue to operate on the same upper level track as it does today.

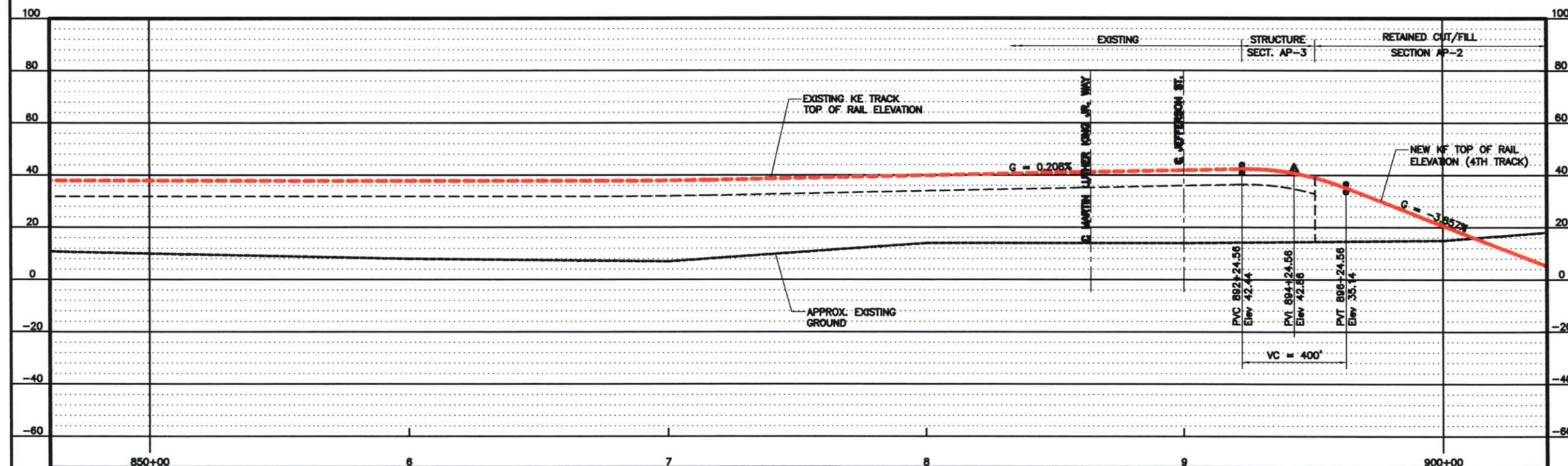
The new 4th track construction would start at the aerial structure at West Oakland near Jefferson Street. The track would diverge from the existing San Francisco to Oakland track to the outside of the existing trackway and enter a mined tunnel section under the existing upper level track. The mined tunnel would join the existing track to the east of the 19th Street Station. See attached plan and profiles for details.

Breakout for the Bay crossing

The new Bay Crossing is shown to start at the existing Oakland Wye breaking out of the existing structure at the point of the existing turnouts; both upper and lower level. This is shown on Sheet BARTWYE1. Depending on the desired operational flexibility and the acceptability of the maintenance complexity these turnouts could be replaced with a simple crossover, a turnout in the dominant direction or a double slip switch for full operational flexibility for normal or emergency operations.



PLAN



PROFILE

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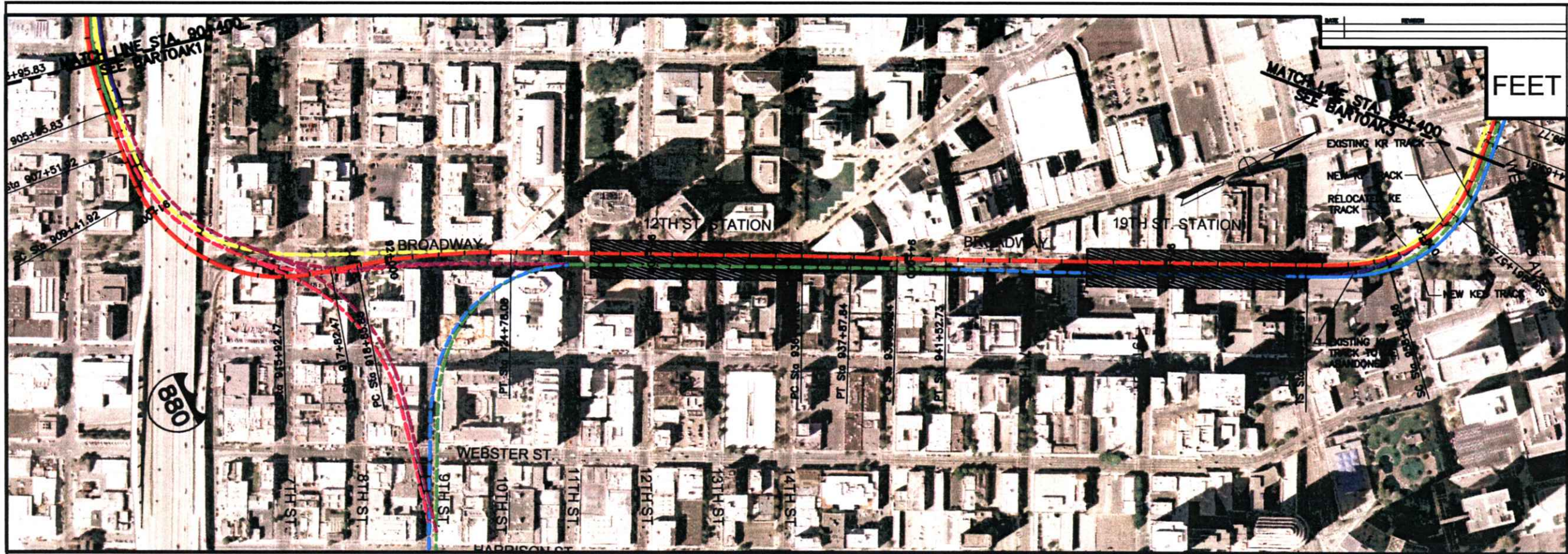
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- SAN FRANCISCO - PITTSBURG
- RICHMOND - FREMONT
- FREMONT - RICHMOND
- SAN FRANCISCO - FREMONT
- FREMONT - SAN FRANCISCO

SCALE
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VERT: 1"=10'

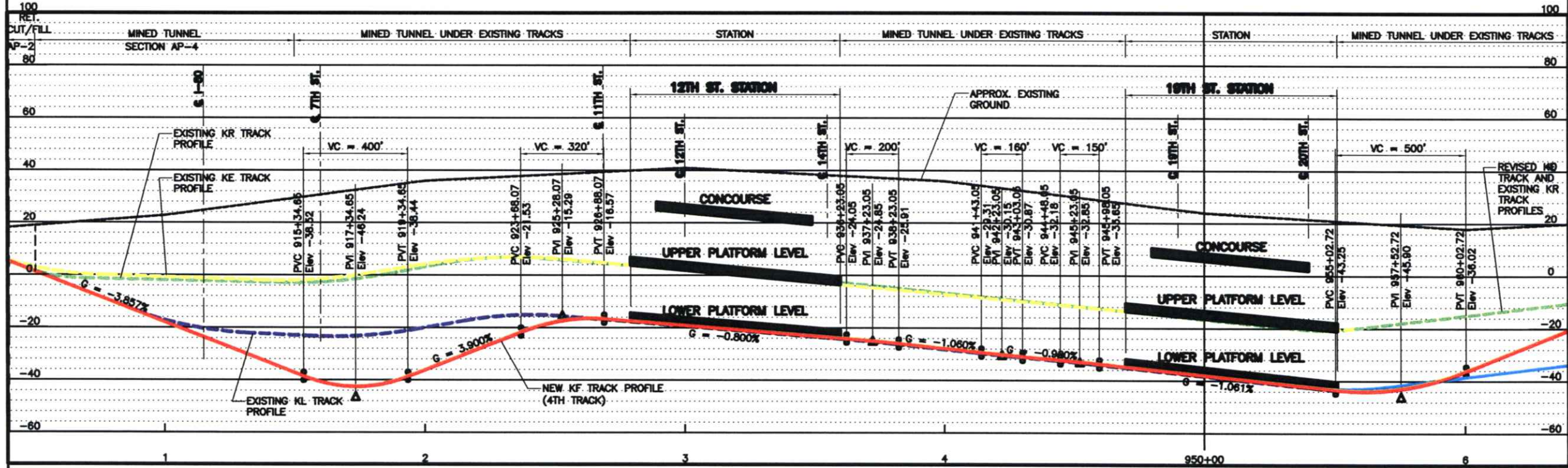
BAY AREA - BAY CROSSING
WEST OAKLAND
EXISTING BART ADDITIONS / MODIFICATIONS

SHEET BARTOAKL
DATE 04-22-07





PLAN



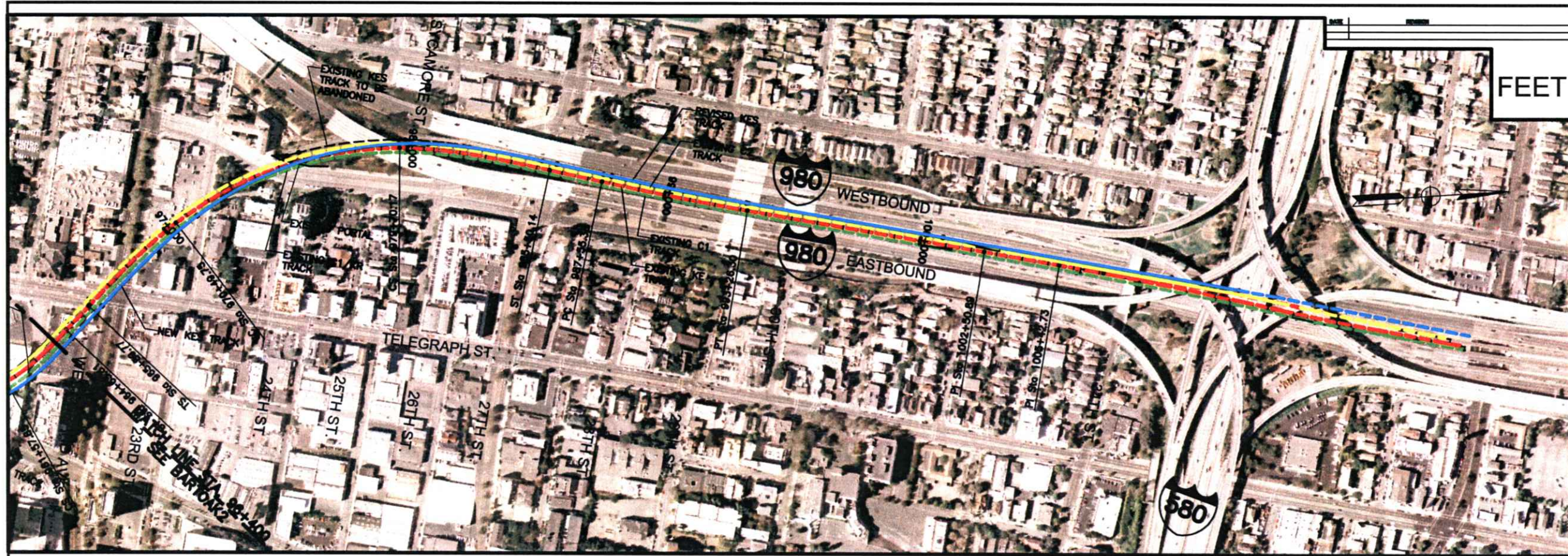
PROFILE

- LEGEND:
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 - RICHMOND - FREMONT
 - FREMONT - RICHMOND
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 - FREMONT - SAN FRANCISCO

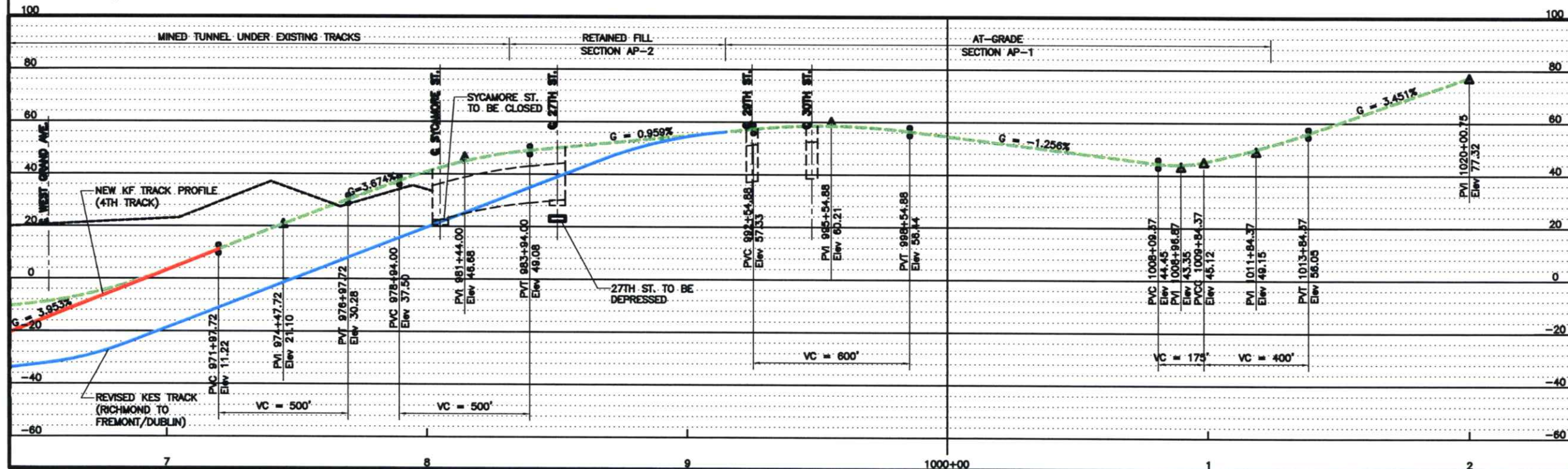
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BAY AREA - BAY CROSSING
 WEST OAKLAND
 EXISTING BART ADDITIONS / MODIFICATIONS

SHEET: BARTOAK2
 DATE: 04-02-07
 SCALE: 1"=100'
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PLAN



PROFILE

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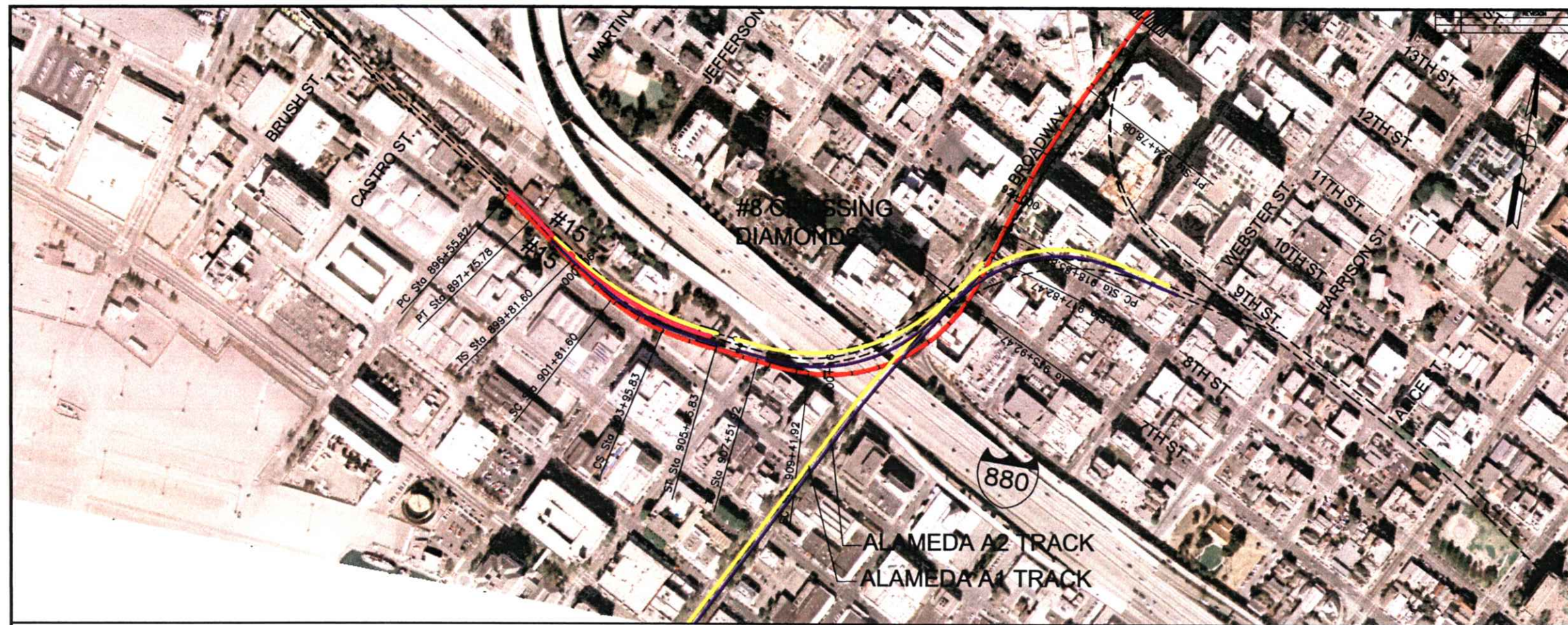
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- RICHMOND - FREMONT
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- FREMONT - SAN FRANCISCO

SCALE
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BAY AREA - BAY CROSSING
WEST OAKLAND
EXISTING BART ADDITIONS / MODIFICATIONS

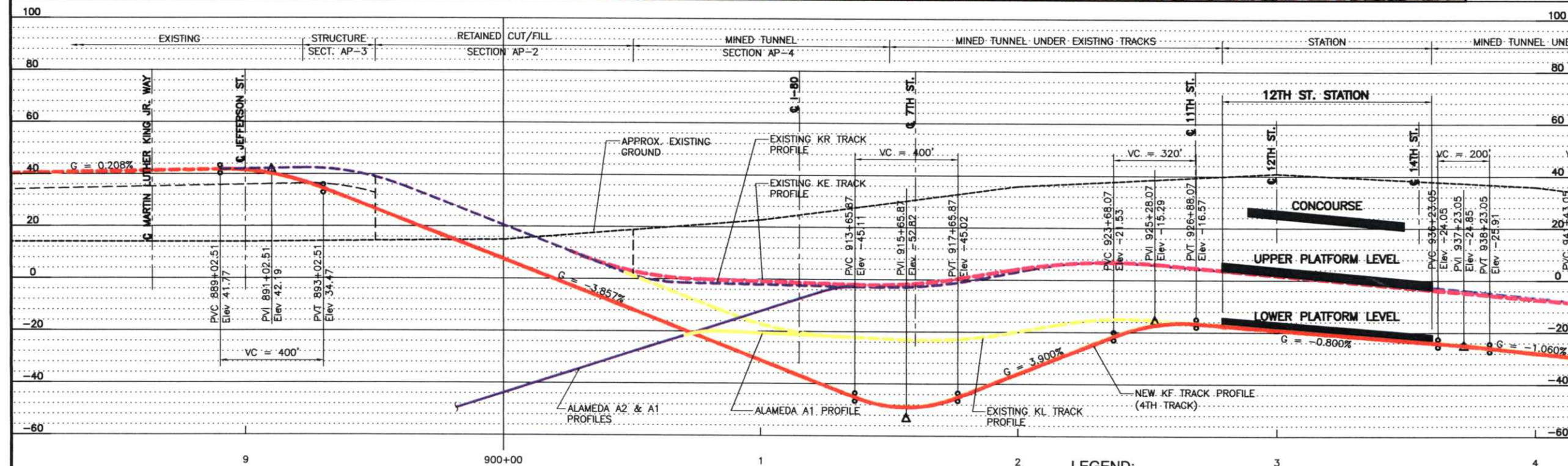
SHEET BART04K3
DATE 04-02-07





FEET

SHEET BARTWEL
DATE 11-09-08



LEGEND:

- SAN FRANCISCO - PITTSBURG
- ALAMEDA/SFO - FREMONT/CONCORD
- FREMONT/CONCORD - ALAMEDA/SFO
- EXISTING TRACKS

SCALE
HORIZ.: 1"=200'
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BAY AREA - BAY CROSSING
WEST OAKLAND
ALAMEDA LINE CONNECTION

Two options have been developed for the BART alignment in San Francisco and Oakland should a new Bay Crossing be required for BART.

1. A Geary Corridor option with the Bay crossing entering at Townsend Street with a Jack London Station in Oakland, see sheet SFO11 for general overview and BARTSF1 for San Francisco alignment
2. A Presidio corridor option with the Bay crossing entering at Folsom Street and no additional station in Oakland, see SFO20 for general overview and BARTSF2 for San Francisco alignment

Both of these options have been designed to interface with a Regional Rail System or High-Speed Rail in Oakland and San Francisco. The Bay Crossing has been shown as a common alignment for BART and Regional Rail / High-Speed Rail. Further analysis should be performed in the future to review the cost effectiveness of a joint four track tunnel or individual two track tunnels.

Bay crossing - West Oakland Wye to Geary corridor

The new Bay Crossing is shown to start at the existing Oakland Wye breaking out of the existing structure at the point of the existing turnouts; both upper and lower level. Depending on the desired operational flexibility and the acceptability of the maintenance complexity these turnouts could be replaced with a simple crossover, a turnout in the dominant direction or a double slip switch for full operational flexibility for normal or emergency operations.

The alignment from Geary and 33rd to the Oakland wye, plan and profiles has been shown on sheets SFBART01, 02, 03, 04 and 05. A non-revenue emergency connection has been shown from the existing BART Mission station to the new line.

After exiting the wye the alignment under this option turns toward Jack London Square to a potential BART Station diagonally under the existing Amtrak Station to allow BART passengers to connect to the long distance and intercity trains along with having access to the local commercial and residential development. The BART tunnel passes beneath the Webster and Posey highway tubes and continues under the Oakland Inner Harbor to Alameda Island. Two Stations are shown on Alameda Island, the exact location of which need to be refined after the patronage input.

The Bay Crossing profile across the Bay is shown as high as possible to facilitate a connection to the Transbay Transit Center (TTC). Future analysis should be performed to optimize the alignment, TTC connection and type of tunnel; sunken tube versus a deep bored tunnel.

A major connectivity station is shown at 4th and Townsend to connect to Regional Rail (Caltrain), High-Speed Rail, MUNI (Central Subway and Embarcadero lines). See technical memorandum 4j for a conceptual layout of the station.

The BART alignment continues under Townsend Street and the US 101 corridor to a Station at Harrison Street. The line turns under Van Ness to a new Station under the existing BART line and MUNI Station in Market Street. A concourse connection to MUNI is anticipated at this location.

The BART line turns from Van Ness Avenue to Geary Street in a fairly deep tunnel heading to a final station at 33rd Avenue. Intermediate stations have been shown at Fillmore Street, Masonic Avenue, Arguello Street, Highway 1 and 25th Avenue. The line is anticipated to be constructed as deep bored tunnel with potential cut and cover stations.

Bay crossing - West Oakland Wye to the Presidio

The breakout from the Oakland Wye is similar to the alignment described above however the line goes directly under the Inner Harbor to the same stations on Alameda Island as in the Option above. The alignment is shown on sheets SFBART21, 22, 23 and ____.

The Bay crossing tunnel is similar to the previous option; however the BART tunnel breaks away from the tunnel going to the 4th and Townsend site under the bay heading to Folsom Street. A station at 1st street has been shown as the connectivity station to the Transbay Transit Center (TTC). This proposed BART station is approximately two blocks southeast of the TTC. If a deeper tunnel is utilized in the future the Station would have to move closer to 2nd Street to accommodate the deeper profile. Another BART station is proposed at 4th Street to connect to the proposed Central Subway. These stations are presently the minimum distance apart according to BART criteria.

The alignment continues in a bored tunnel turning beneath Van Ness Avenue to a proposed Station adjacent to City Hall. No direct connection to existing BART or MUNI is possible with this alignment except possible an underground walkway to either station at the BART Civic Center or the MUNI Van Ness station. There are a total of three stations along Van Ness all at minimal spacing. The Stations would all be fairly deep; approximately 80' to 130' and would most likely be constructed by mining methods. The other stations are proposed at Geary Street and Washington Street.

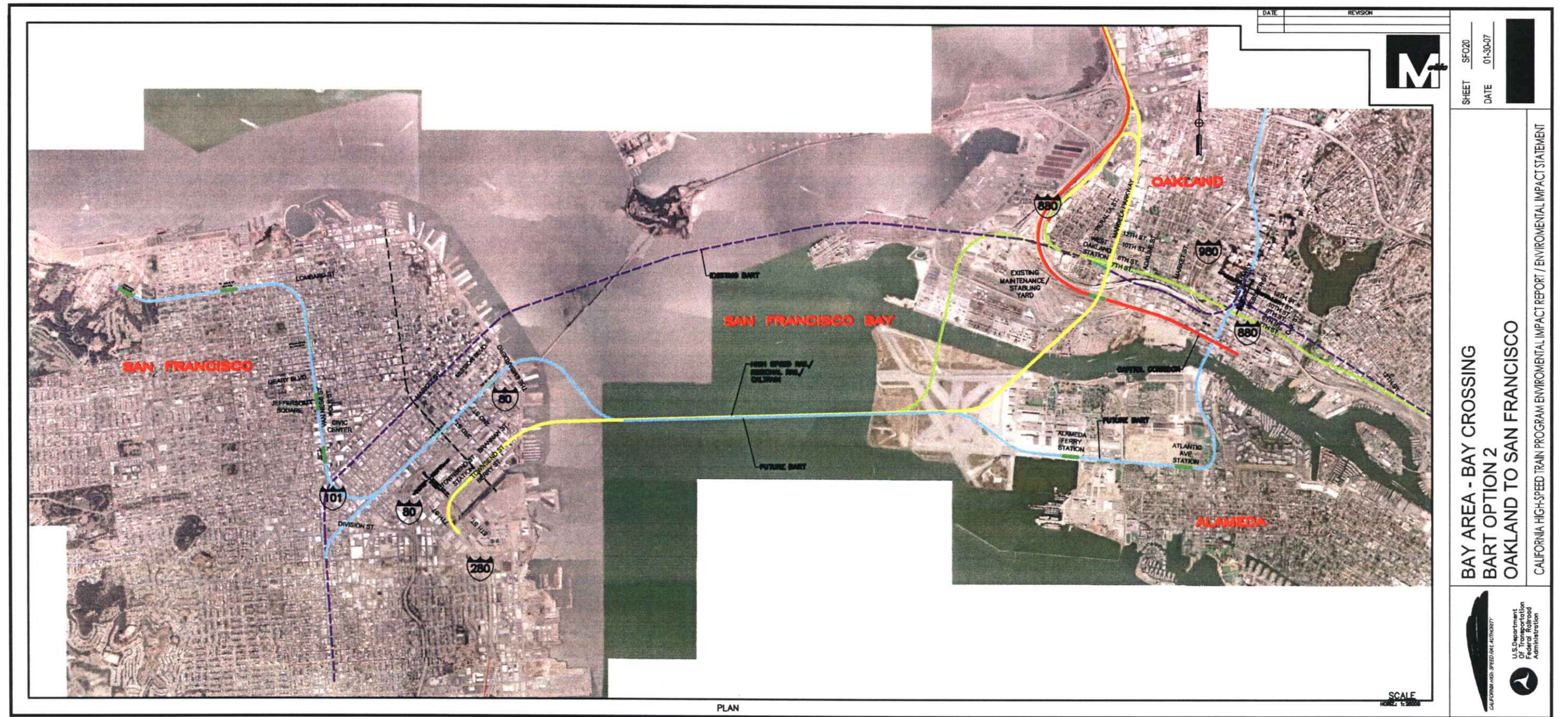
The alignment turns west on Lombard Street passing under the residential homes at a minimum depth of 60'. A station is proposed at Fillmore Street and a terminus station at the Presidio near Lincoln Boulevard. The Presidio Station could serve as an intercept station for the transit traffic originating from the Golden Gate Bridge. The exact location of the Presidio station would need to be verified during future design to account for on-going development, future extensions and connections across the bridge and the location of historic structures. The Fillmore and Presidio Stations are at minimum depth and would most likely be constructed by cut-and-cover.

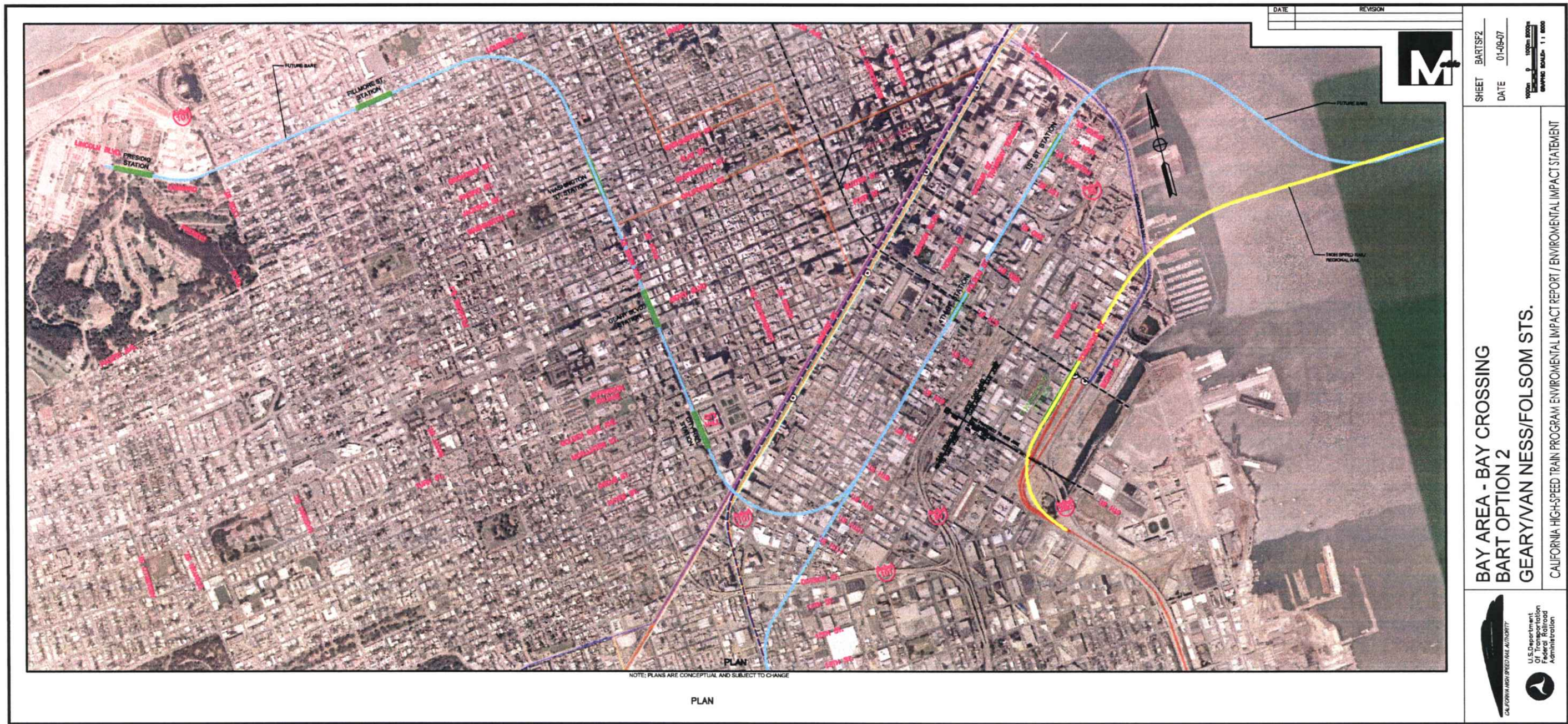
West Oakland Regional / HSR Rail

The West Oakland Station and the transbay connection has been designed for ultimate operational flexibility and not necessarily for ultimate cost effectiveness. Once the patronage data has been developed and the operational plan verified to serve the projected patronage the plan should be optimized from a cost effectiveness viewpoint. The transbay crossing should be reviewed as to individual deep bore tunnels or a combined sunken tube.

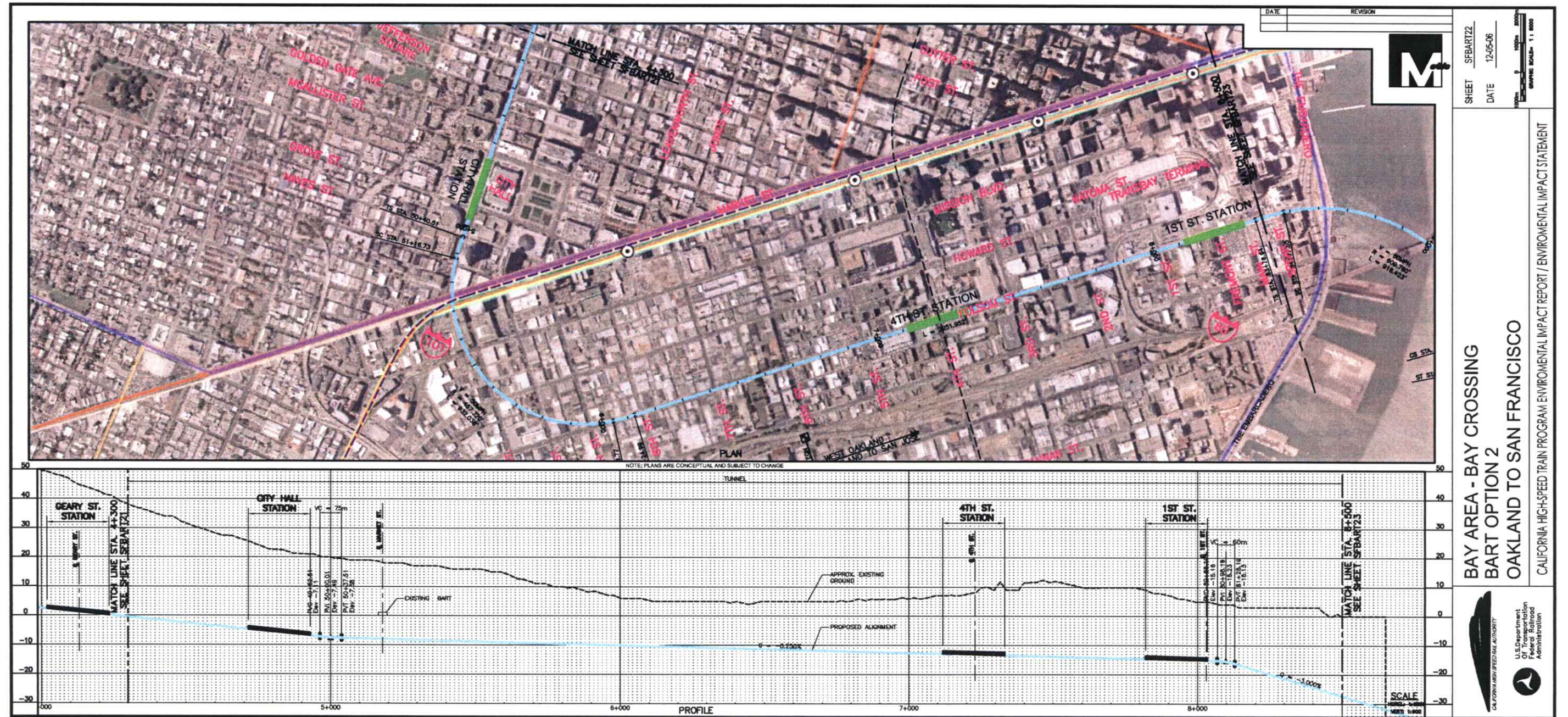
The plan as shown represents a sunken four track tube with High-speed Rail and Regional Rail (as light weight, non-compliant equipment) on the upper level with BART on the lower level. If the analysis for the BART crossing should result in that the BART crossing is not justified and a regional rail crossing is not feasible and high-speed rail comes in from Oakland to San Francisco then the HSR crossing should be shortened and be placed in a deep bore tunnel heading to the 4th and Townsend Station for cost effectiveness.

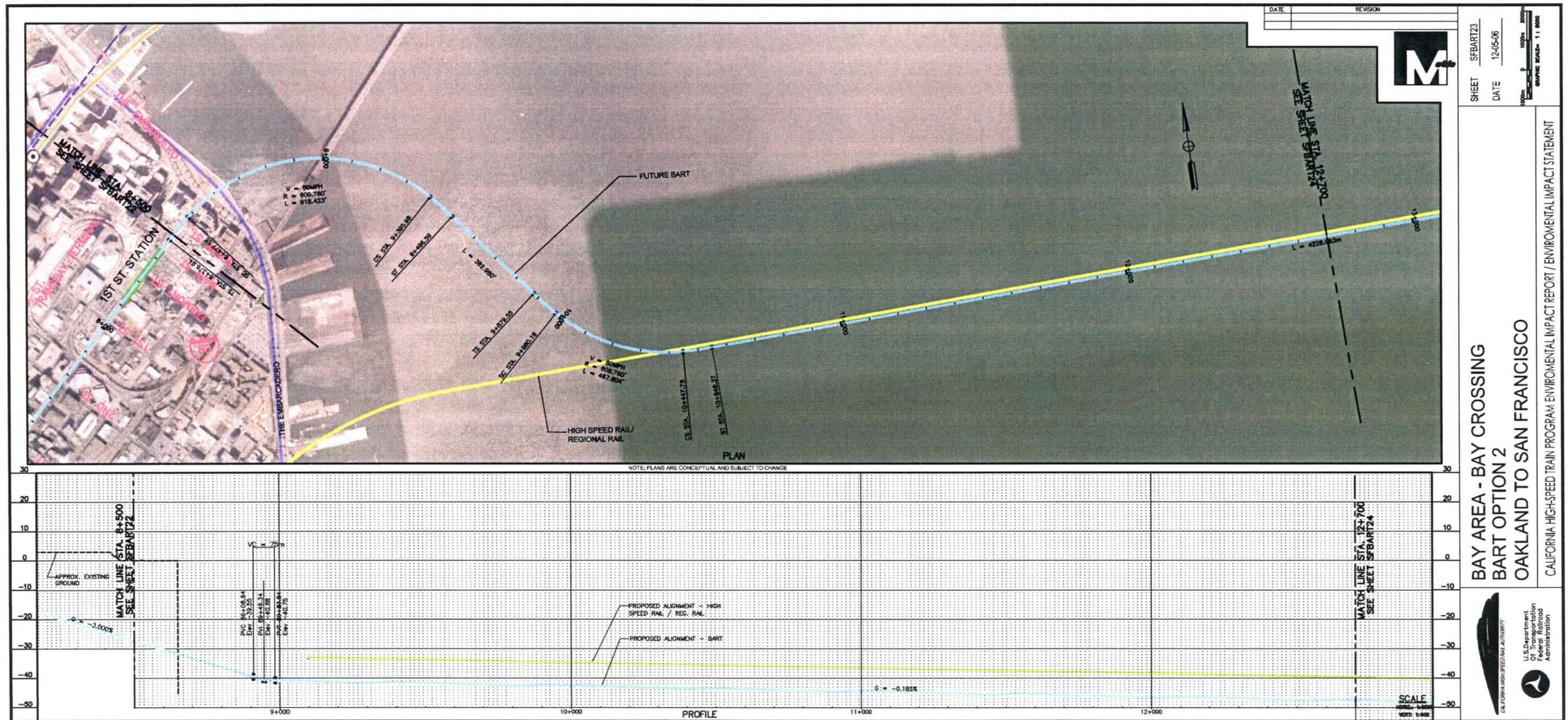
The possible Regional Rail extension from the peninsula to the east bay and beyond is shown in yellow on the attached drawings along with a potential yard location adjacent to the I-880 highway. It is the deepest alignment at the West Oakland Station. See Technical Memorandum 4j for details. The potential highspeed rail alignment is shown in green.

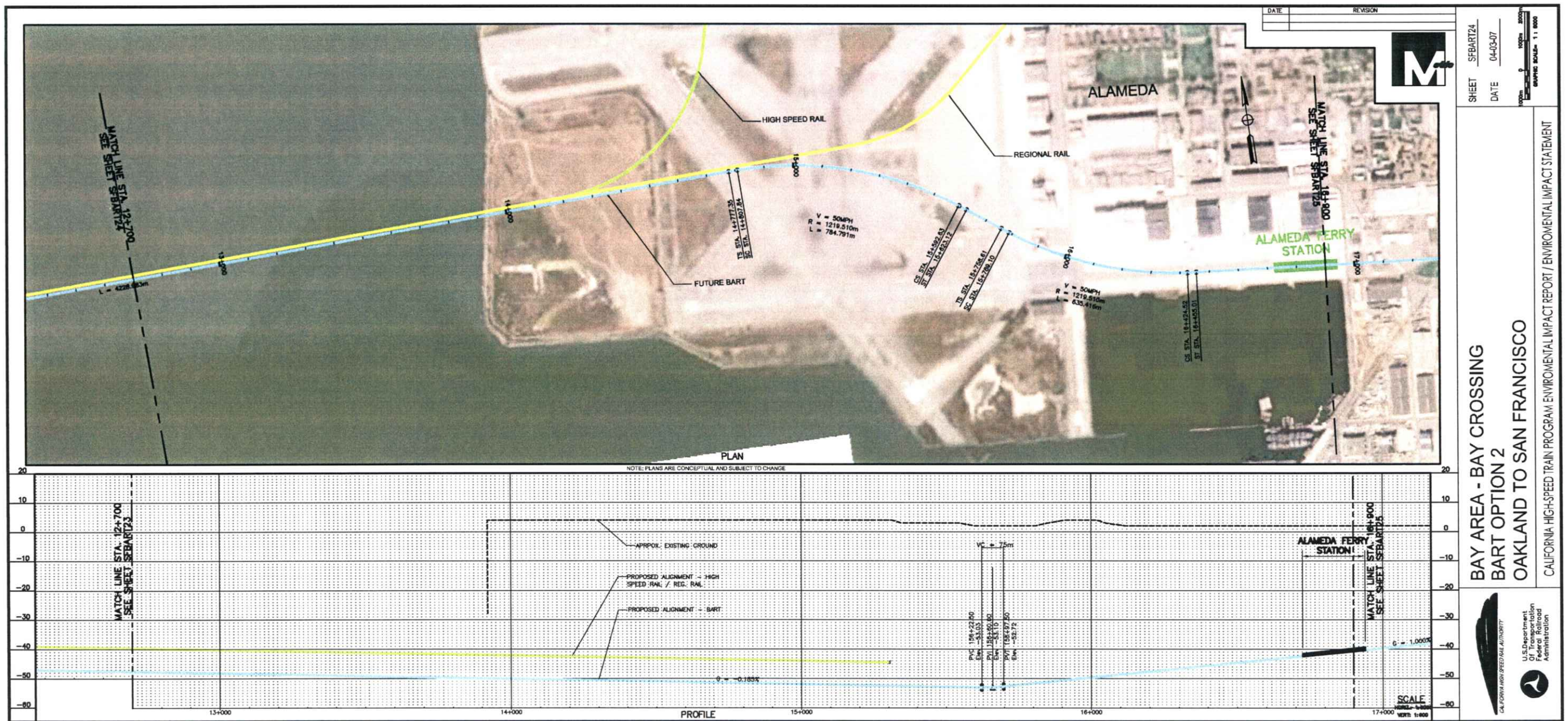


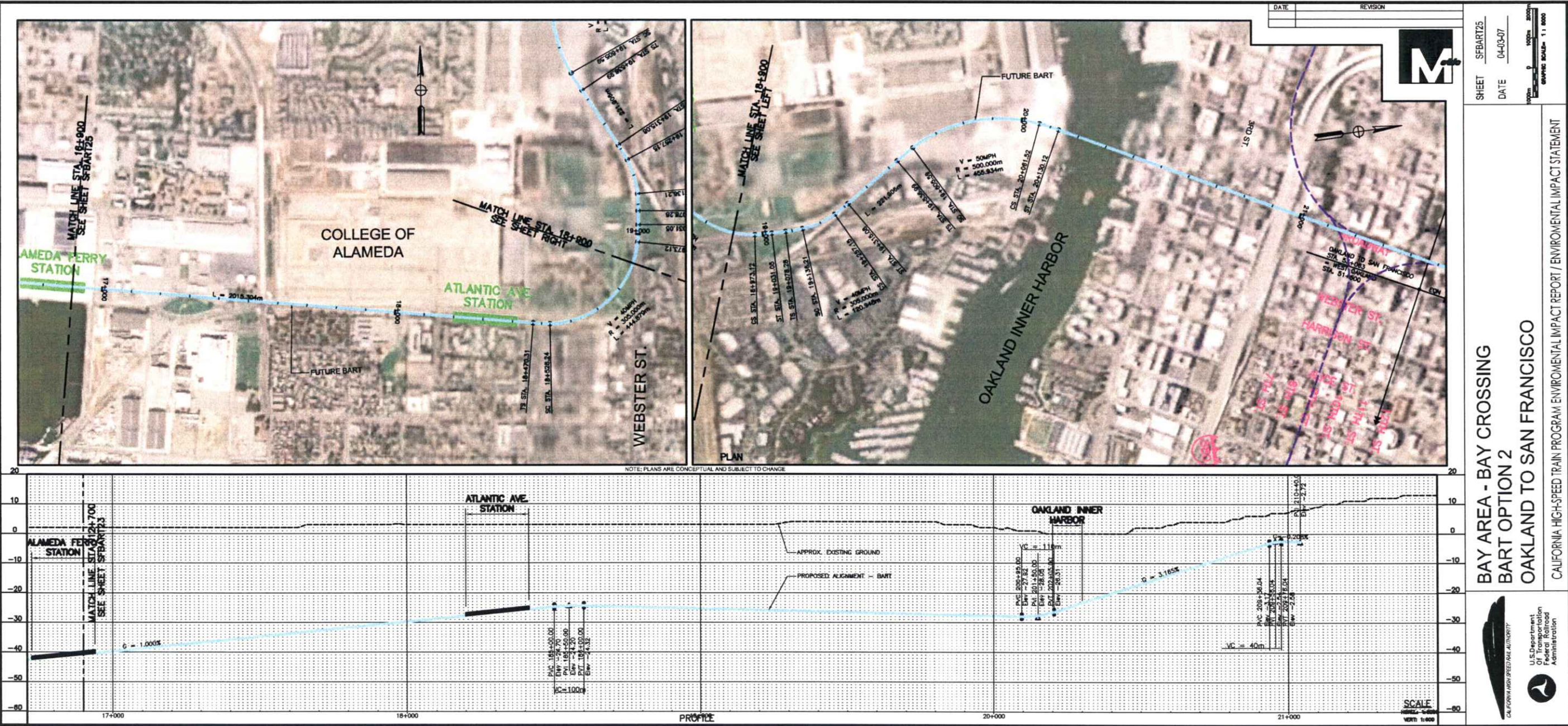








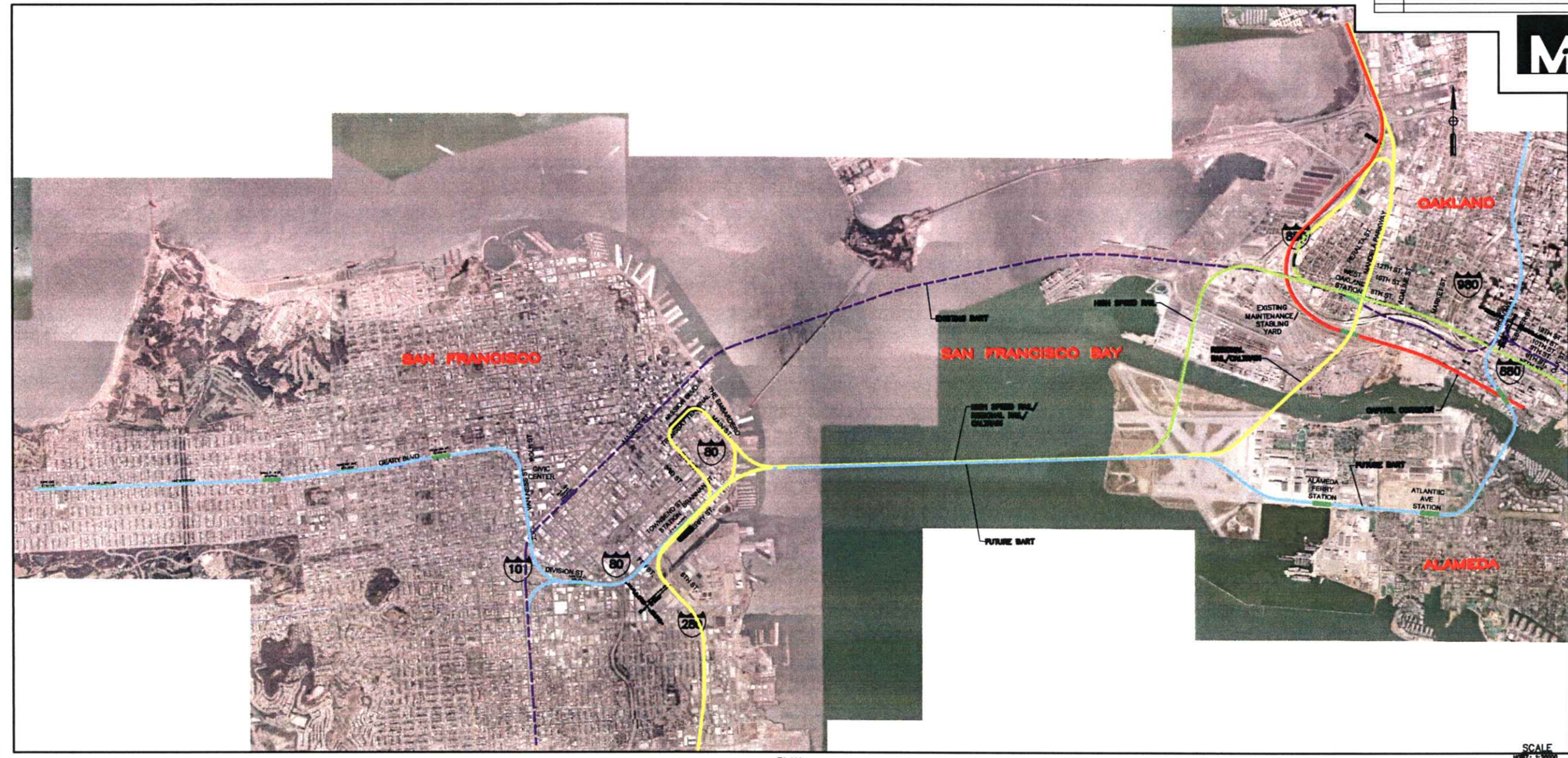




DATE	REVISION



SHEET	SFO11
DATE	01-09-06



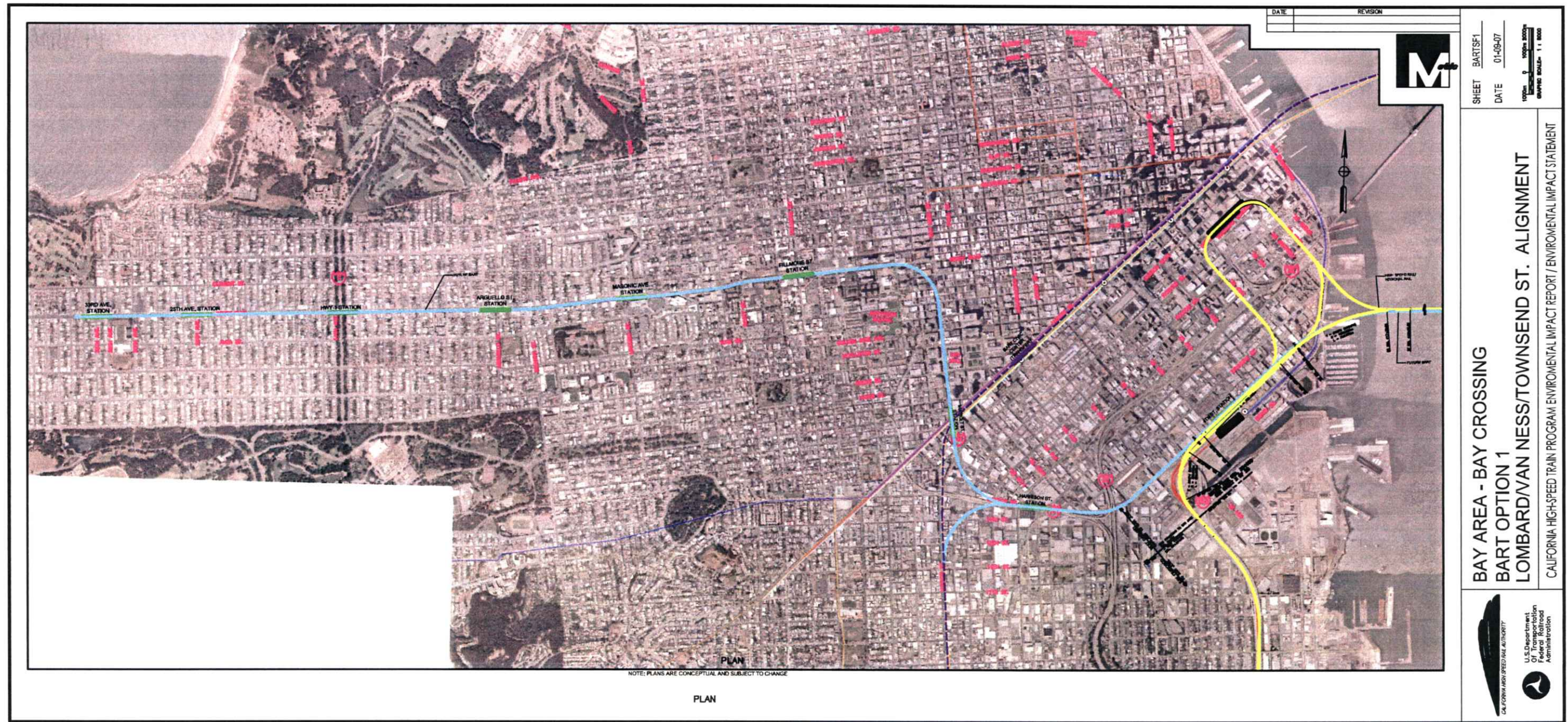
PLAN

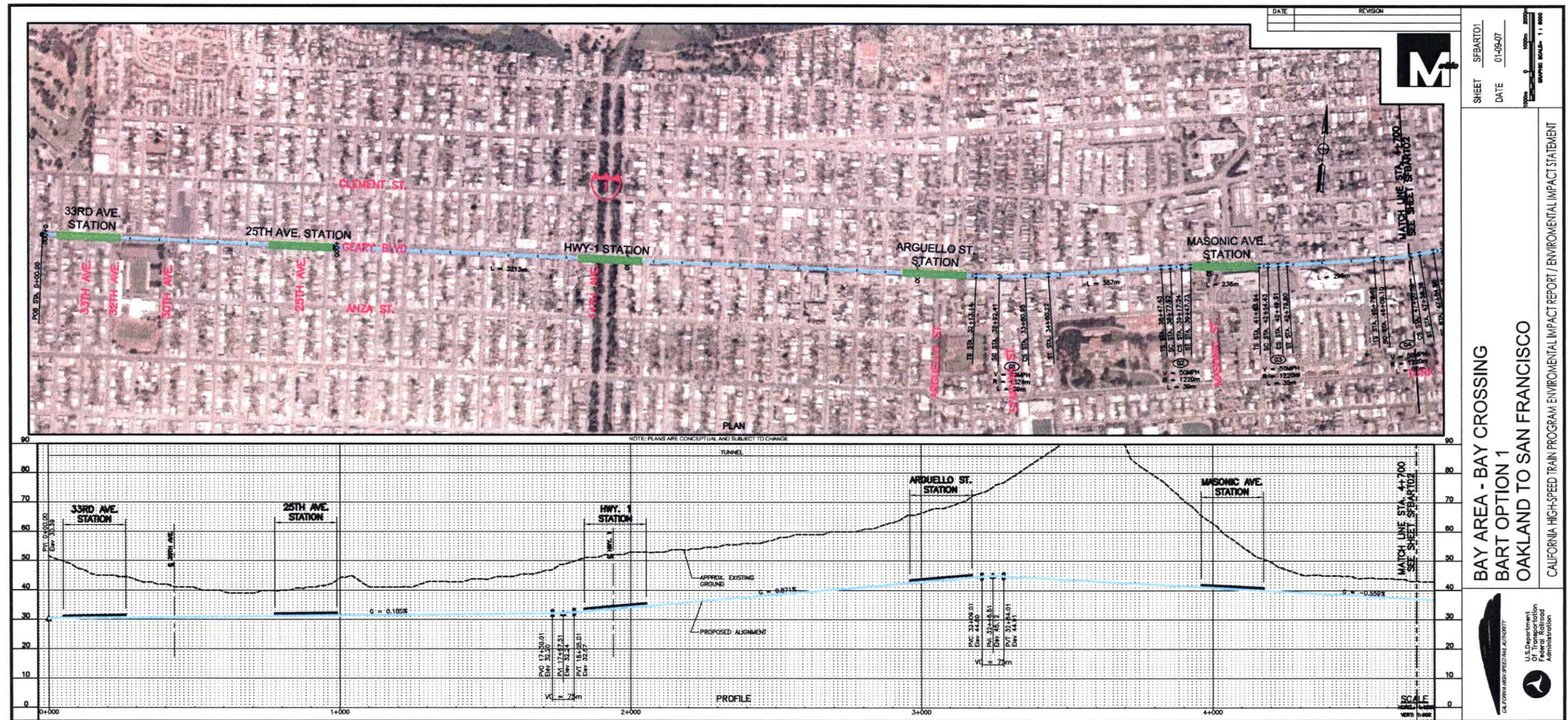
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HORIZ 1\"/>

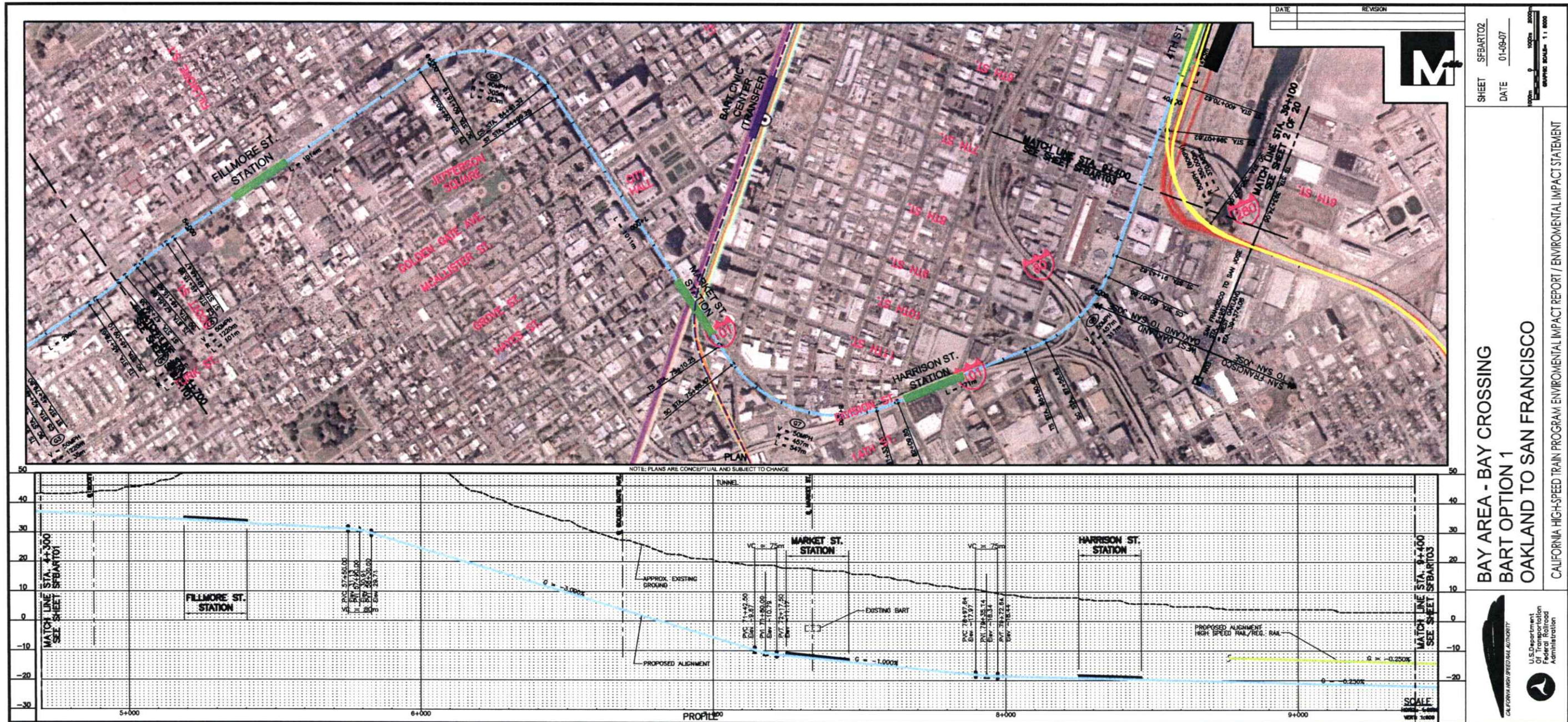
**BAY AREA - BAY CROSSING
BART OPTION 1
OAKLAND TO SAN FRANCISCO**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT







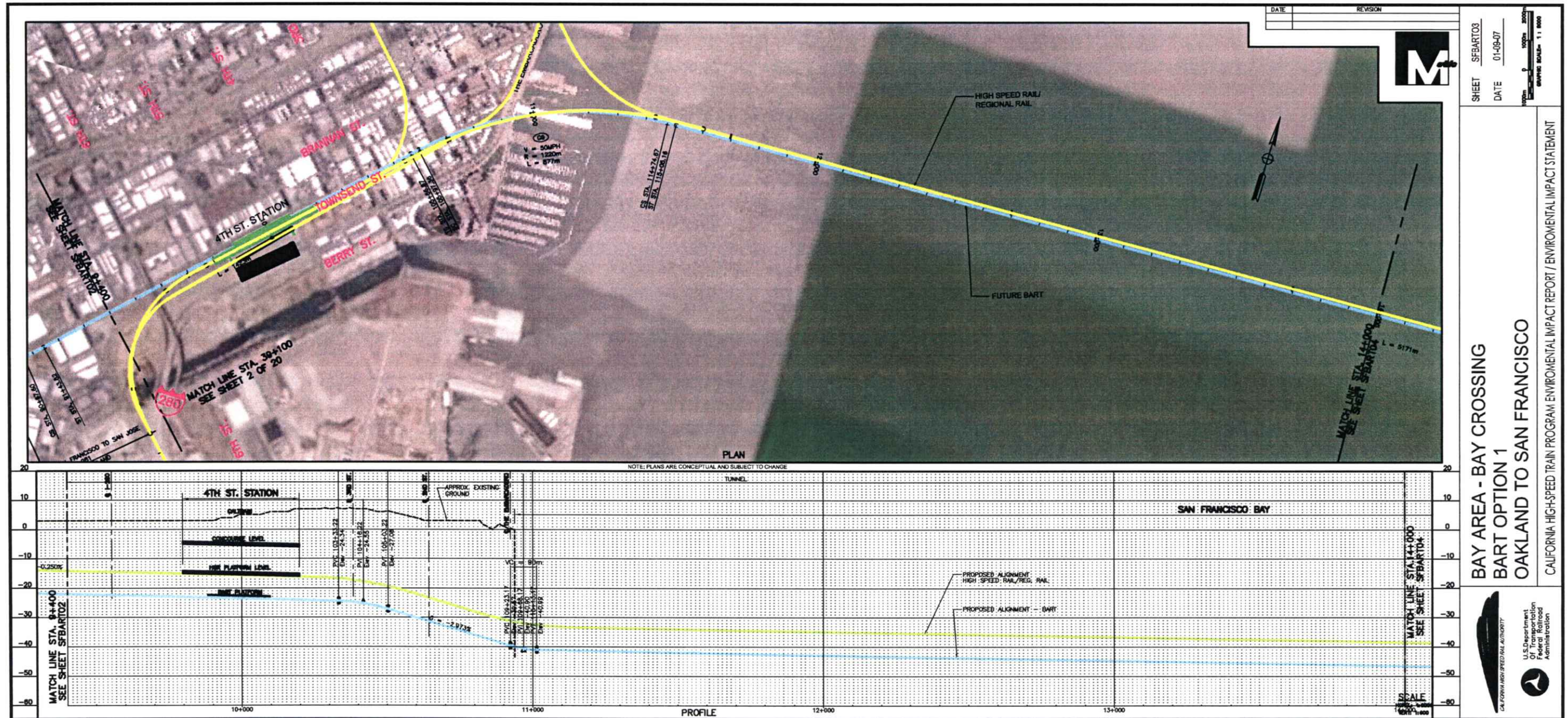


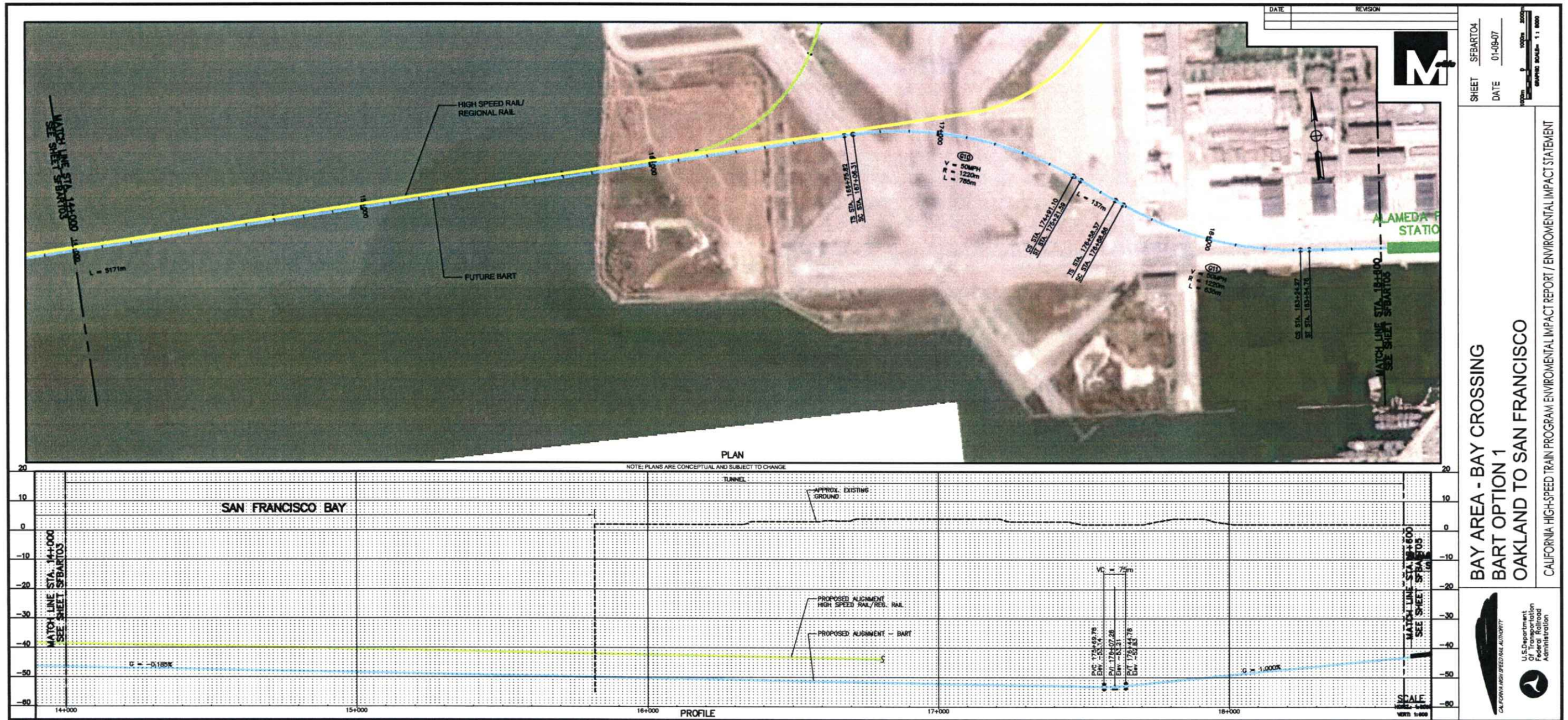
BAY AREA - BAY CROSSING
BART OPTION 1
OAKLAND TO SAN FRANCISCO

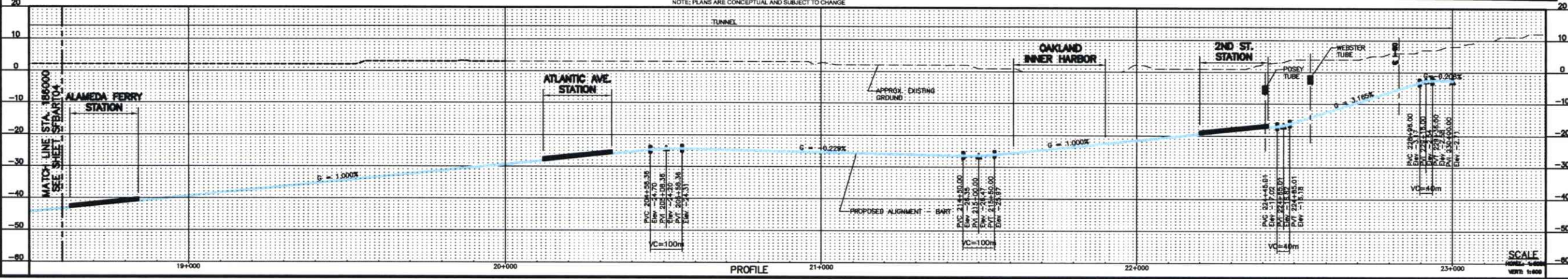
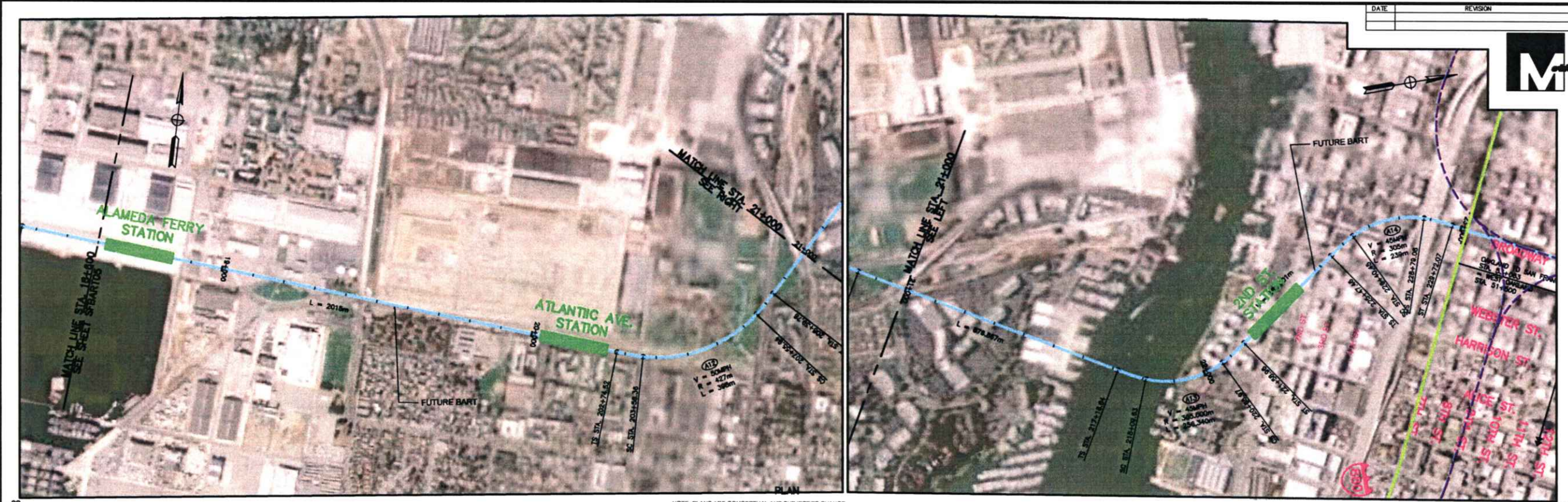
SHEET: SFBART02
 DATE: 01-09-07

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

U.S. Department
Of Transportation
Federal Railroad
Administration







BAY AREA - BAY CROSSING

BART OPTION 1

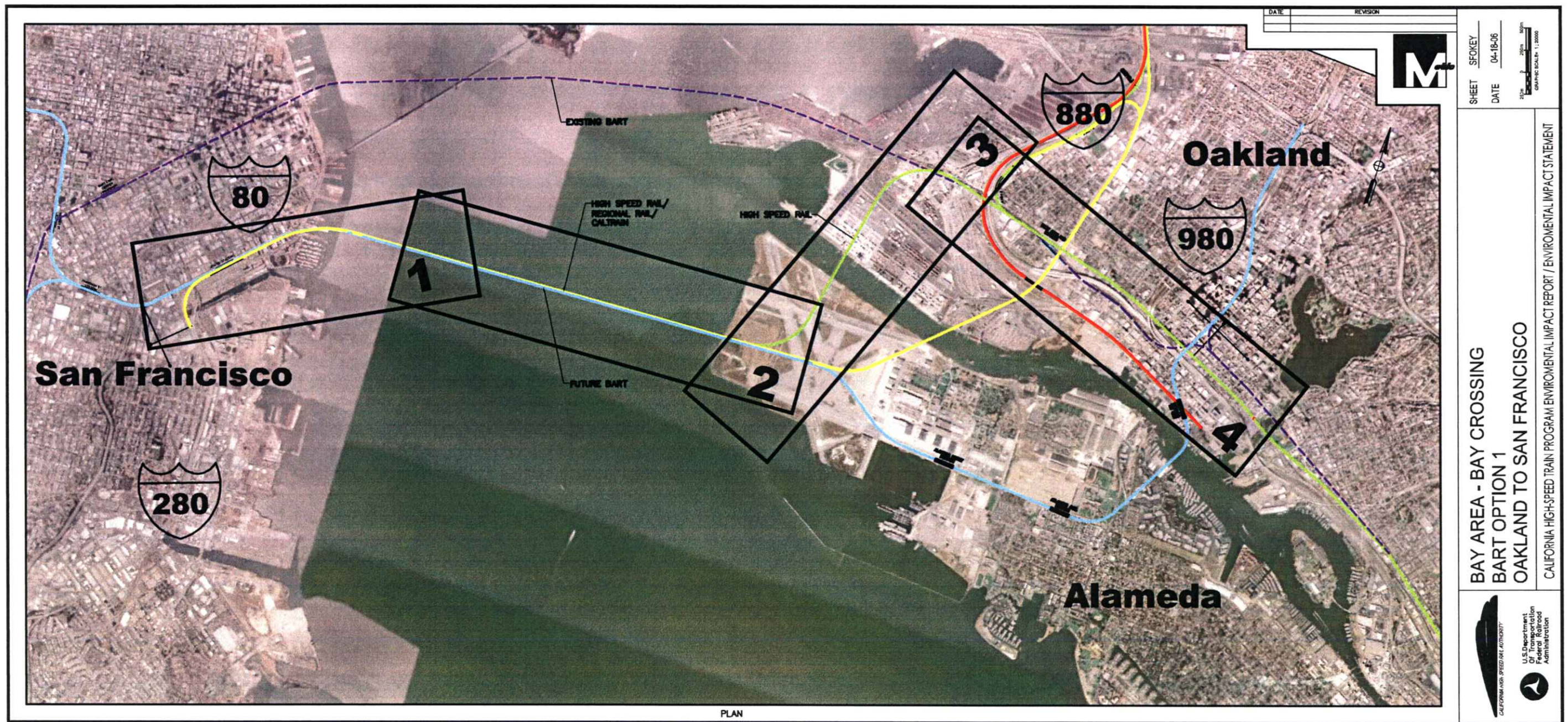
OAKLAND TO SAN FRANCISCO

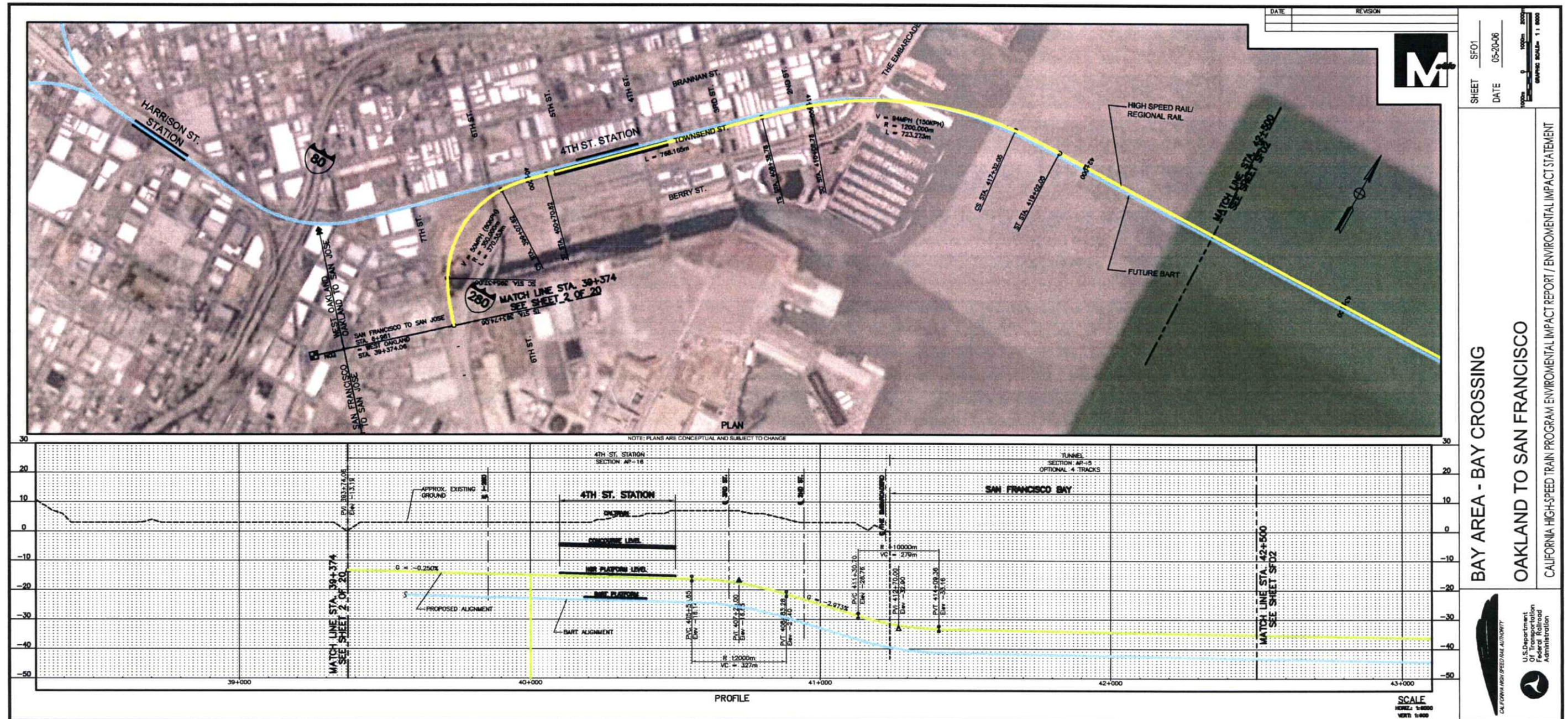
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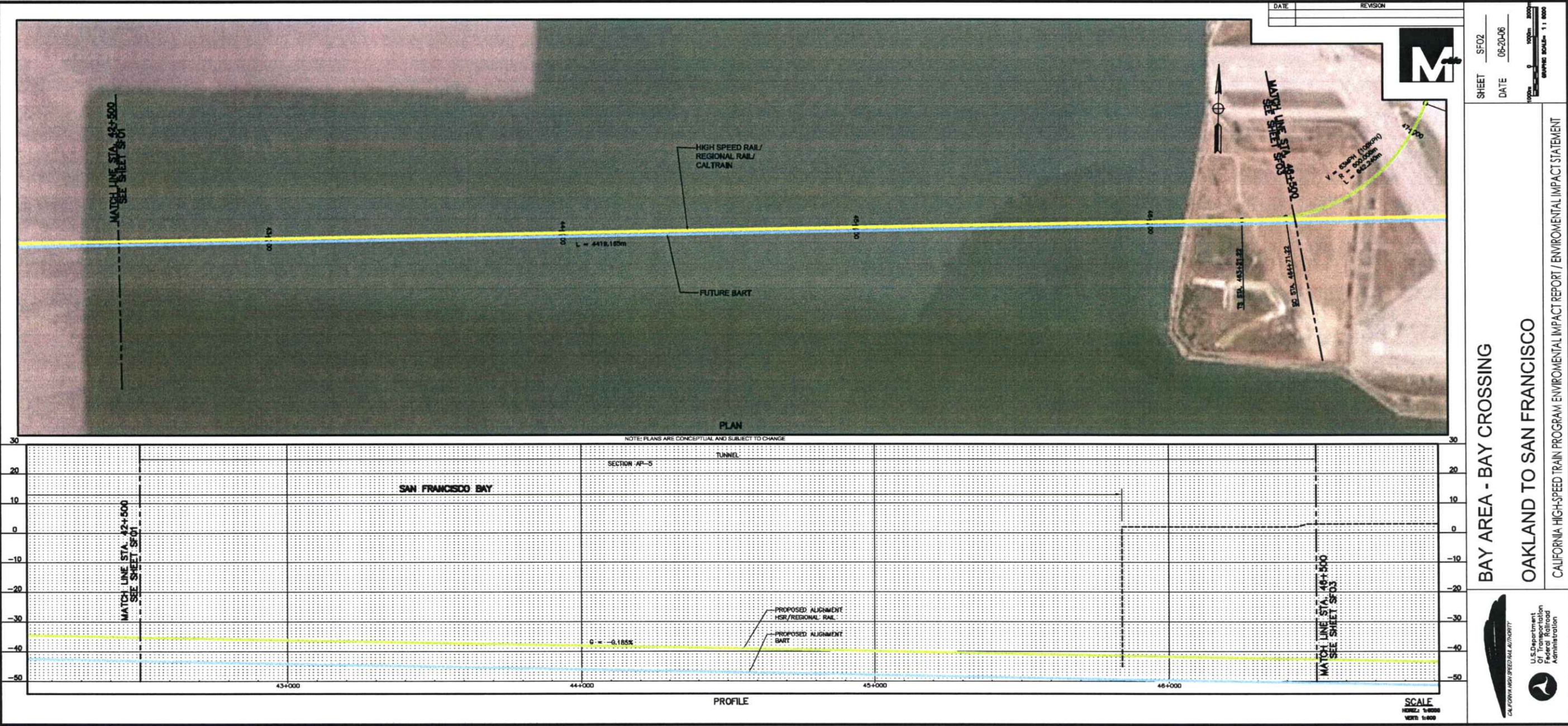
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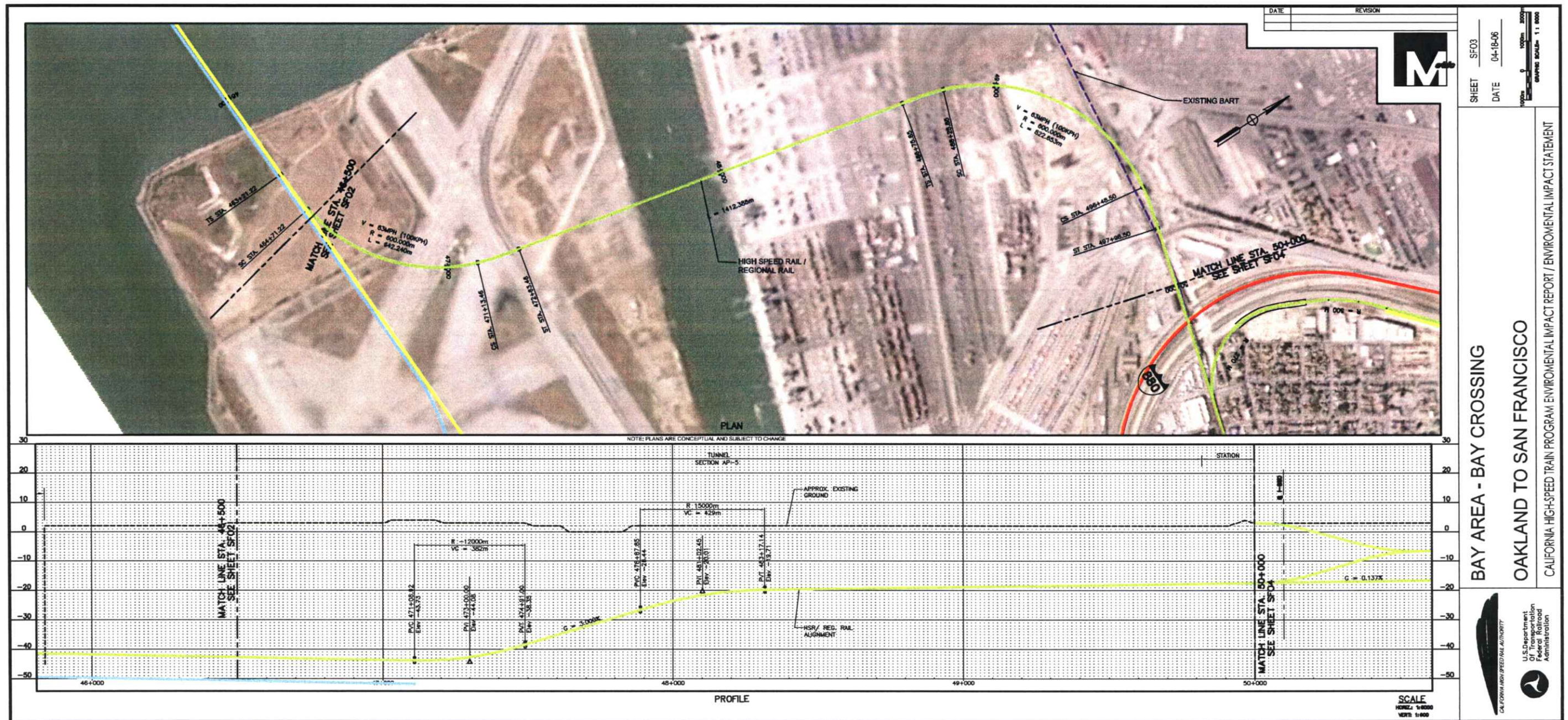
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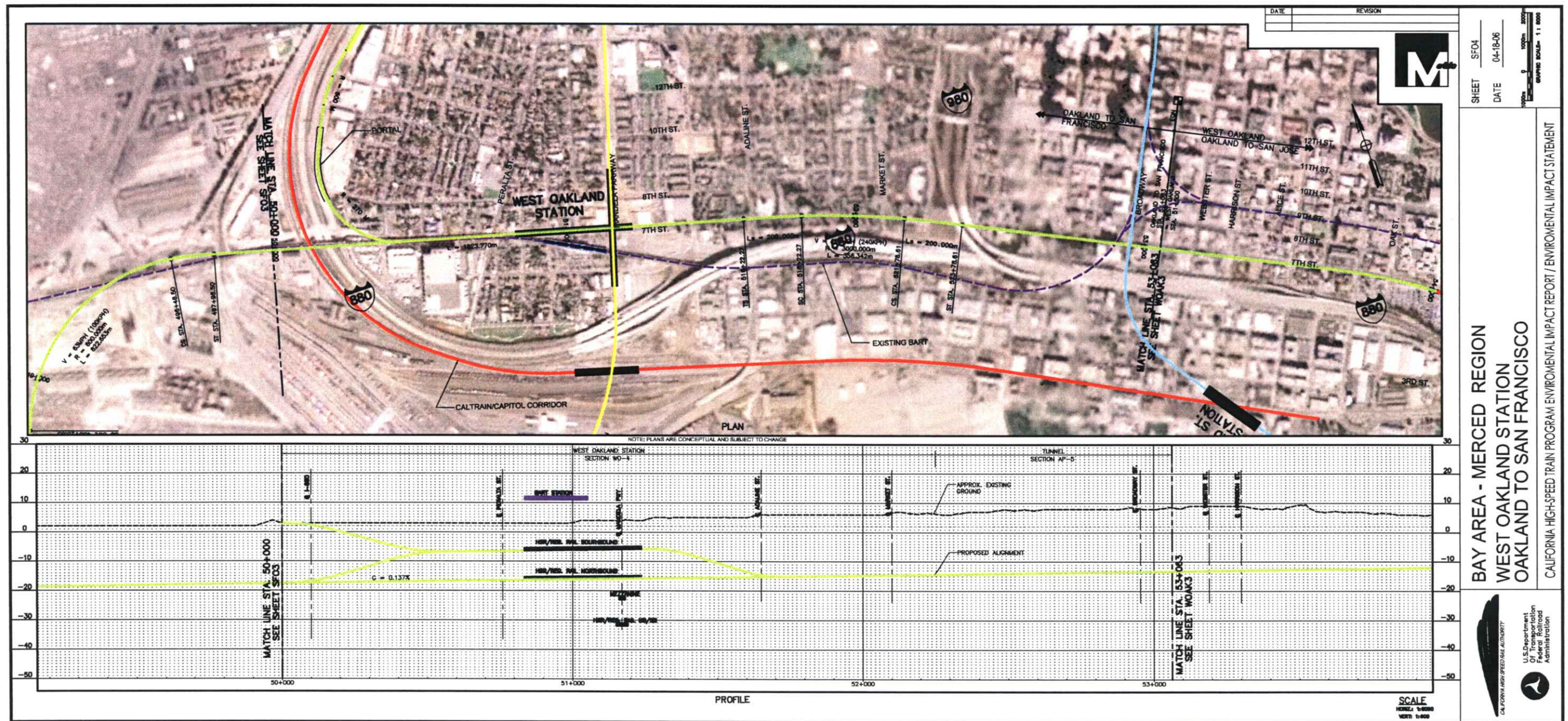
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT











Altamont corridor – from Tracy to Redwood City

The route over the Altamont Pass has been designed for both heavy (compliant) and lightweight (non-compliant) equipment. Study Alternative 1 represents the existing heavy equipment and utilizes the existing tracks as much as possible; it is generally a two track system. Alternative 2 represents the light weight equipment and includes new alignment portions; Altamont Pass and the Niles tunnel. It is generally shown as a four track system.

Study Alternative 1 uses existing UPRR tracks from Stockton to Newark along with portions of the “old SP” tracks and Caltrain tracks across to the Peninsula. The alignment uses the downtown Tracy Station location in a two track at grade configuration and connects to the existing UPRR tracks over the Altamont just east of the I-5 highway. The existing Livermore Station would be relocated to the Isabel Avenue location to connect to BART. The existing Pleasanton Station would remain in its present location with a second track added for capacity. The route through the Niles Canyon would utilize both the existing UPRR track and an upgraded “SP” track during the week for directional freight and passenger traffic. The Dumbarton project would add a third track through the Centerville portion of the Niles Sub-division and a grade separation with the Coast Sub-division at Newark and these are assumed to be in place. The Dumbarton Bridge under this alternative would remain single track. All Stations are assumed to be double track for capacity reasons.

Study Alternative 2 follows the same general alignment as Alternative 1 with the concept that it is a separate passenger and freight system; therefore a four tracks system. The alignment is shown on sheets ALTAKEY, ALTA1 through 9 in addition to ALTA5OP2 and ALTA6OP2; an Altamont Pass alignment variation. The description is from the Peninsula to Tracy / Manteca.

The alignment starts at the Caltrain corridor near Redwood City with a connection to both the north to San Francisco and south to San Jose direction. The alignment is at-grade with local roads as underpasses in a two track configuration. A two track Station is shown at Willow Road. All Stations on this alignment along with the track configuration are designed to be expanded to a four track concept in case the High-speed rail system should utilize this corridor in the future.

The line continues across the Bay in one of four options; low level bridge (two options), high level bridge and a tunnel. For the Dumbarton Bridges three options are under consideration. The first is a low level option which would supplement a new single track crossing that is under consideration as part of the Dumbarton Rail Corridor Project. This would entail adding a second track in a configuration similar to that proposed for the Dumbarton Rail Corridor Project and would stay within the existing right-of-way. This would allow freight traffic using temporal separation. Conceptual plan and profiles are attached for all bridge options.

A second option is for a dual-track low level crossing that would not rely on the prior construction of the Dumbarton Rail Corridor Project. This alignment is outside of the existing right-of-way to maintain the existing bridge and track for freight traffic and would impact the Don Edwards Wildlife Preserve.

The third option is the high level dual track alternative, which is a stand alone project that does not require the construction of the Dumbarton Rail Corridor Project. This alignment is again outside of the existing right-of-way to maintain the existing bridge and track for freight traffic and would impact the Don Edwards Wildlife Preserve.

Dumbarton Option 1

Dumbarton Option 1 consists of the addition of a single track parallel to the Dumbarton Rail Corridor. There is 7.3 km of low level viaduct as well as two lift bridges. One of the lift bridges is in the bay and would be at the same location as the proposed lift bridge of the Dumbarton Rail Corridor Project. A second lift bridge would be location over the Newark Slough.

For the low level viaduct we have assumed a precast concrete superstructure with typical spans of about 30-meters. The deck width has been set at 6-meters. The sub-structure is assumed to be a pile bent.

The low level viaduct is of fairly simple construction – we have used a cost of \$3,000 per square meter, or \$18,000,000 per kilometer for single track, which is slightly higher than that used for short span highway structures to account for the fact that much of the work occurs over water.

For the two lift bridges a cost per square meter of \$13,500 (\$162,000,000/km) has been used – given that the lift bridge are only a small portion of the construction the overall cost is not sensitive to the square meter cost of the lift bridges.

These costs result in a construction cost of \$149 million. As with the other bridges we have added an environmental mitigation contingency, in this instance of 10%. To this add 7% to design; 12% for construction management and 35% contingencies.

This results in an estimated project cost for Dumbarton Option 1 of \$244 million.

Dumbarton Option 2

Option 2 is essentially the same as Option 1 except that this Option is for a dual-track. The cost for dual-track was taken as \$36,000,000 per kilometer.

This configuration results in a construction cost of \$298 million. As Option 1 we have added a 10% environmental mitigation contingency. To this add 7% to design; 12% for construction management and 35% contingencies.

This results in an estimated project cost for Dumbarton Option 2 of \$488 million. Right-of-way impact costs will need to be added to this option.

Dumbarton Option 3

This option consists of about 7 km of high level viaduct and is dual track. The superstructure would likely consist of precast-post-tensioned box girder.

Typical spans have been assumed at 75-meters. The sub-structure would consist of hollow concrete piers which would be up to about 30-meters above the water level. The deck would be 12-meters in width.

Typical cost of this type of structures is on the order of \$5,000 per square meter, or \$64,000,000 per kilometer. This results in a construction cost of \$439 million.

Adding 10% as an environmental mitigation contingency; 7% for design P,S & E; 12% for construction management and 35% contingencies results in a project cost for Dumbarton Option 3 of \$720 million. Right-of-way impact costs will need to be added to this option.

Dumbarton Tunnel Option

The tunnel option is envisioned as a deep three bore tunnel using a pressure balanced tunneling machine. The tunnel portal on the peninsula end would be just after the Willow Road Station. The alignment across the Bay would be outside of the existing bridge alignment to avoid the bridge foundations. The east bay portal would be outside of the Don Edwards right-of-way close to the potential Station at Willow Street in Newark. Ventilation shafts would need to be at either end of the tunnel.

Alignment

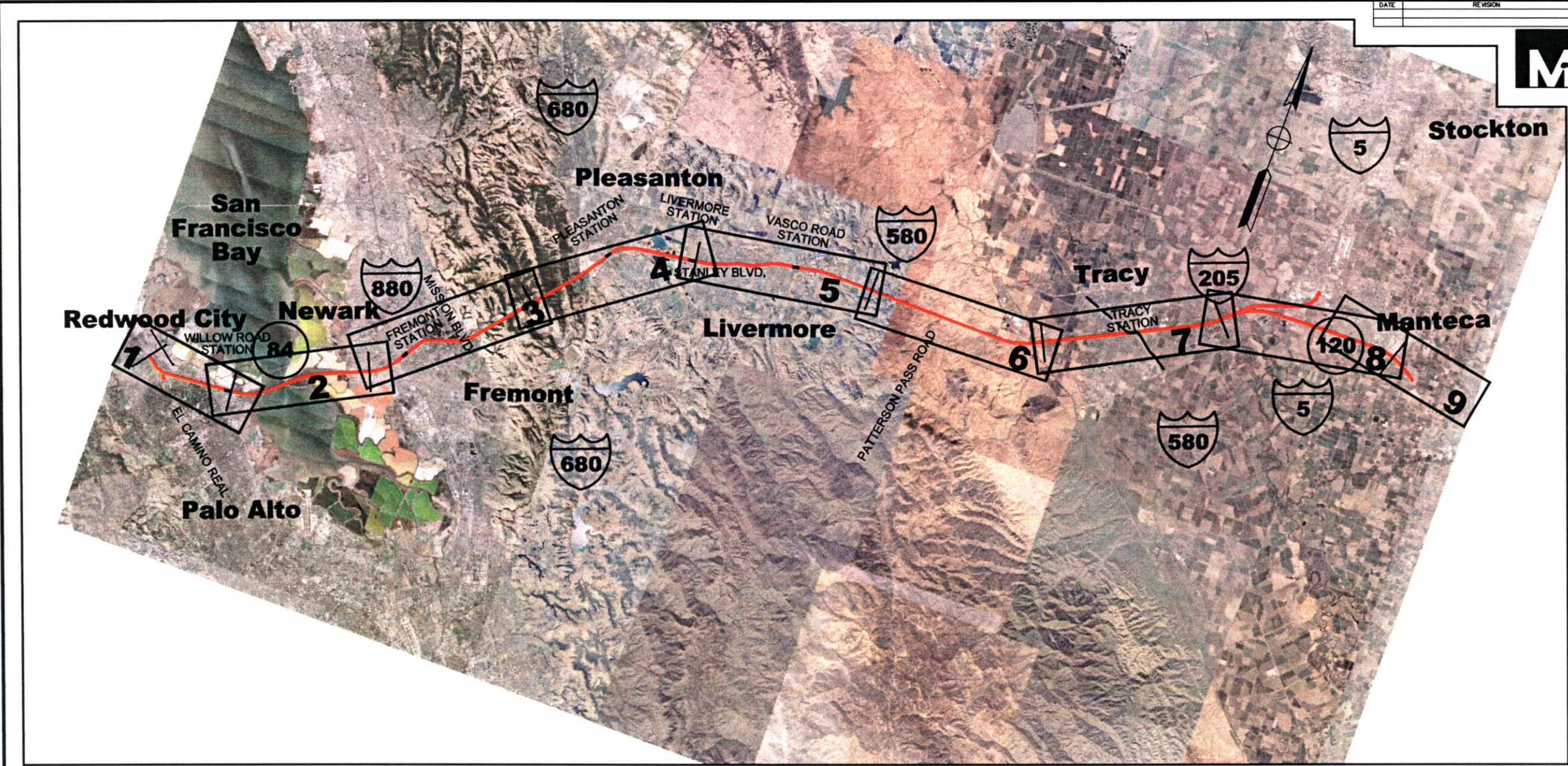
The alignment continues through Newark along the Dumbarton Alignment with a grade separation (tunnel) at the Newark Junction with the Coast sub-division of the UPRR. The line is at-grade through a proposed Station in Fremont near Blacow Road. It becomes an aerial alignment before Fremont Boulevard and continues this way over the BART tracks, over Niles Junction to a new tunnel alignment through Niles canyon. There is insufficient right-of-way from Fremont Boulevard to Niles to allow for an at-grade solution.

The tunnel emerges to an at-grade solution prior to the Calaveras Fault passing beneath I-680 to a four track Station in Pleasanton; two freight and two passenger tracks. The existing corridor from this point to the end of the existing rail corridor near Greenville Avenue will need to be reconfigured with containment walls to allow the four tracks within the existing right-of-way. Consideration should be given from Valley Avenue in Pleasanton to Isabel Avenue in Livermore to purchase additional property to provide additional separation between the freight and passenger tracks.

The proposed station at Isabel Avenue is to provide a connectivity station for Regional Rail, BART and potentially High-speed rail. The Station is designed as a potential four track station for Regional Rail and high-speed rail in the future. BART is a separate two track facility with storage tracks after the station. See technical memorandum 4j for conceptual design of the Station.

The alignment leaves the existing UPRR corridor near Vasco Road to go over the Altamont Pass utilizing one of two options; one going over the pass near Patterson Road using the existing Vasco Road Station location the other slightly north closer to I-580 using a different Vasco Road station location. The differences are the amount of earthwork versus length of line and impact on the wind turbines. Future studies should determine the final alignment.

The proposed alignment ties into the existing UPRR corridor east of I-5 and proceeds to a new aerial station in downtown Tracy. The Station passes over the existing Mococo freight line. It continues in a general at-grade configuration to Stockton and to the existing UPRR in the highway 99 corridor. Additional tracks will have to be added from Tracy to Stockton for the passenger service.



PLAN

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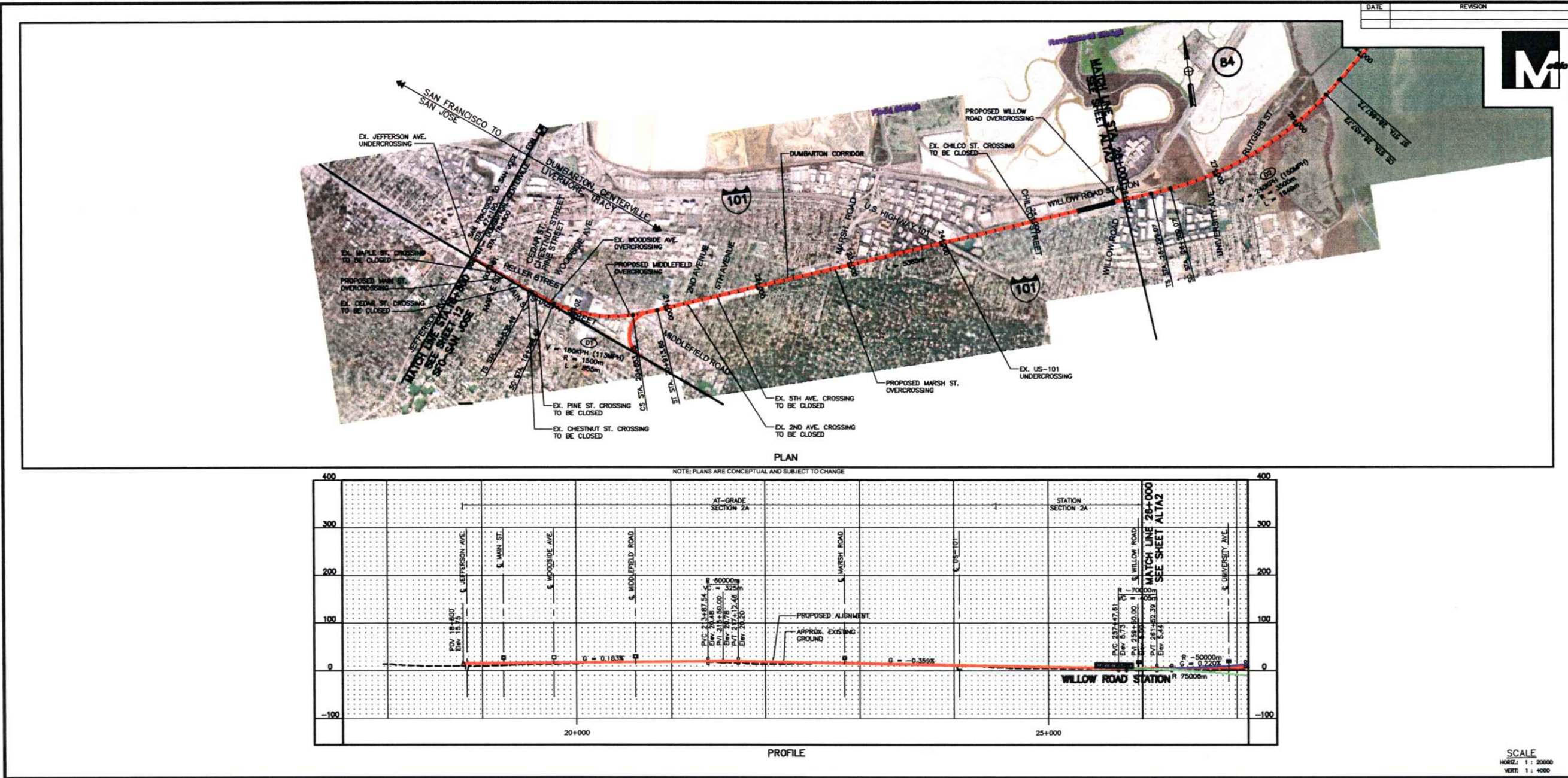
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GRAPHIC SCALE 1:2000

BAY AREA - ALTAMONT PASS
DUMBARTON - CENTERVILLE - LIVERMORE
PATTERSON PASS & TRACY ALIGNMENT

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT





SHEET

ALTA1

DATE

02-28-07

BAY AREA - ALTAMONT PASS

DUMBARTON-CENTERVILLE-LIVERMORE

PATTERSEON PASS & TRACY ALIGNMENT

U.S. Department of Transportation
Federal Highway Administration

SCALE

HORIZ 1 : 20000

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DATE

02-28-07

REVISION

U.S. Department of Transportation
Federal Highway Administration

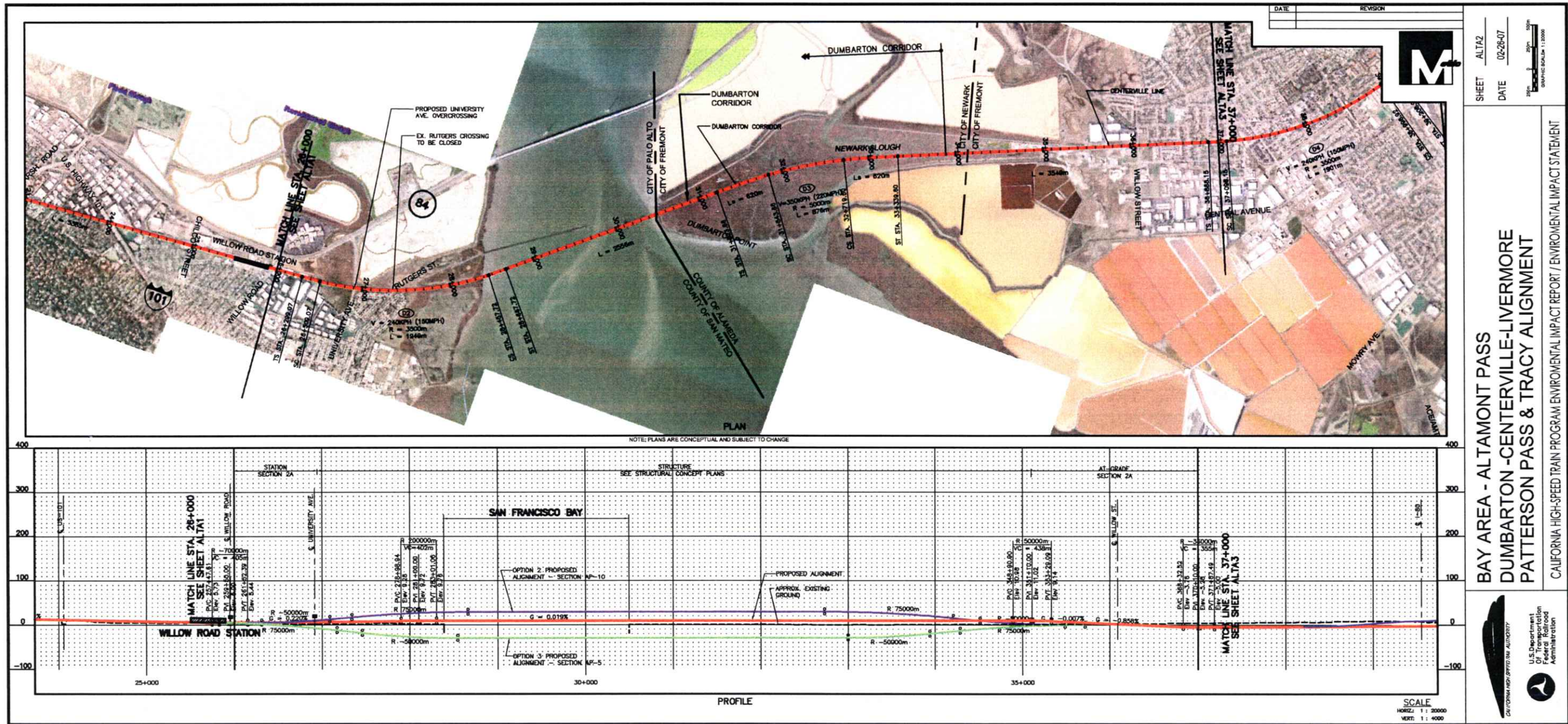
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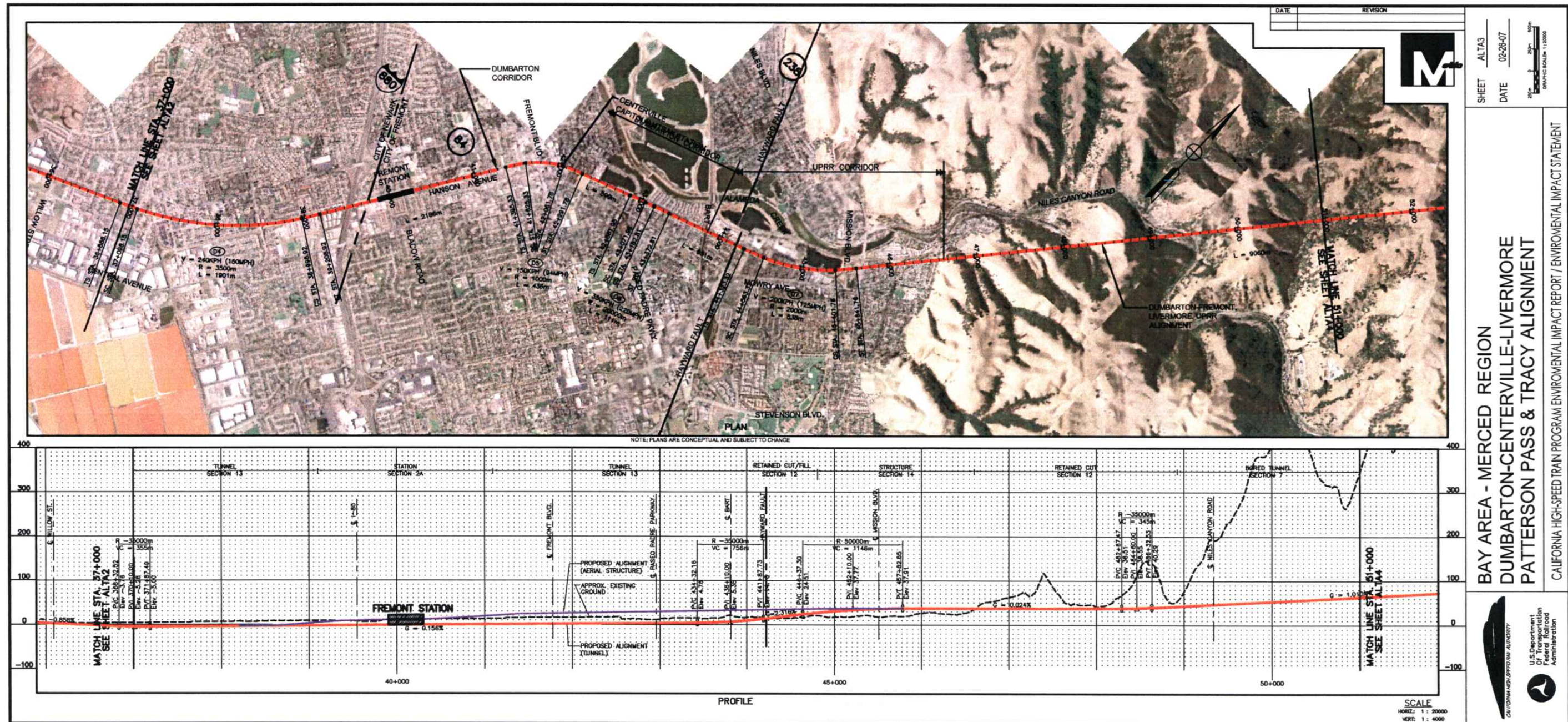
U.S. Department of Transportation
Federal Highway Administration

CALIFORNIA HIGH-SPEED TRAIN AUTHORITY

U.S. Department of Transportation
Federal Highway Administration

CALIFORNIA HIGH-SPEED TRAIN AUTHORITY





SHEET **ALTA3**

DATE **02-28-07**

DATE _____

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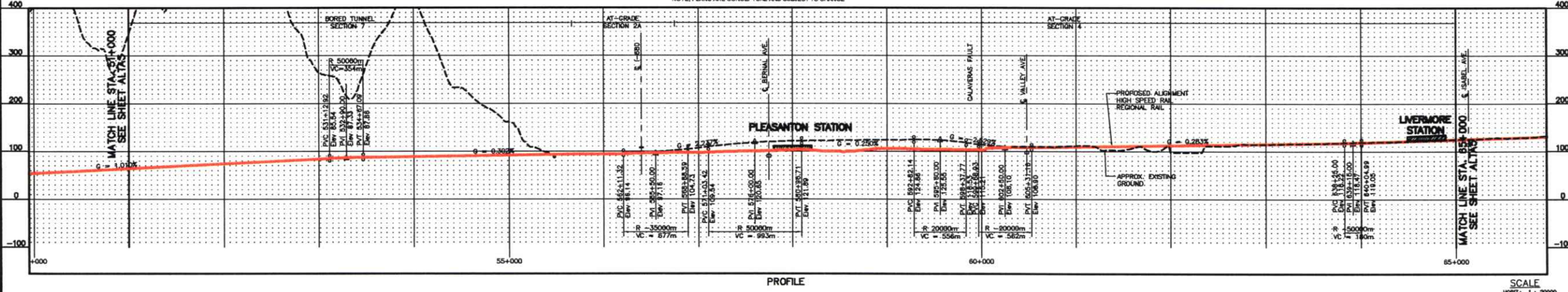
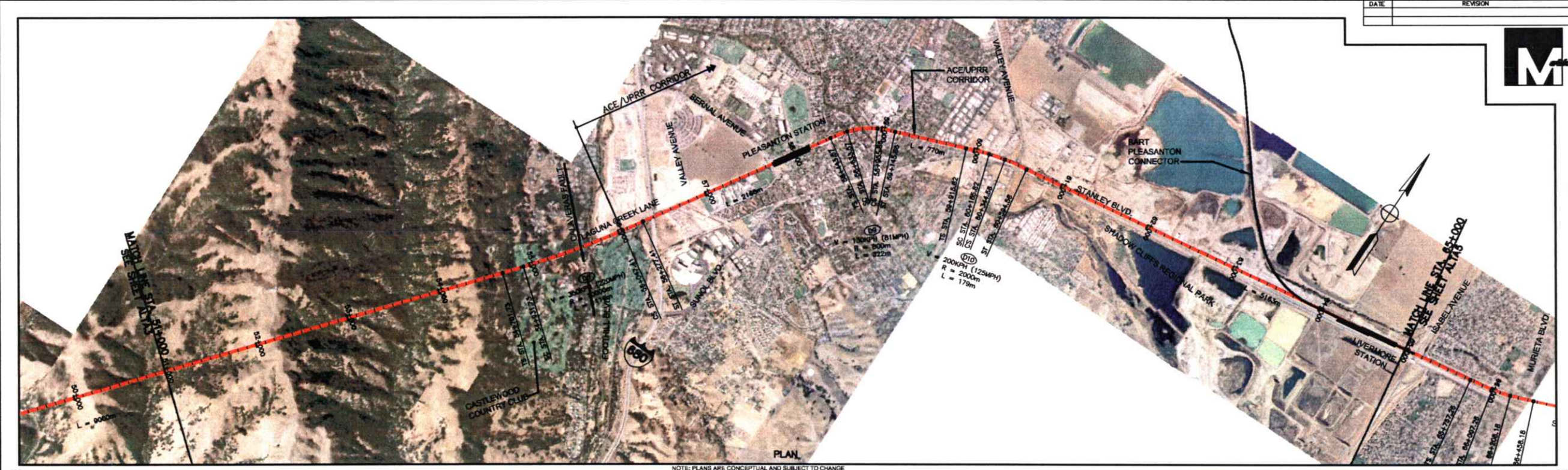
BAY AREA - MERCED REGION

DUMBARTON-CENTERVILLE-LIVERMORE

PATTERSON PASS & TRACY ALIGNMENT

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

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Federal Railroad
Administration



DATE	REVISION
01-31-07	ALT4

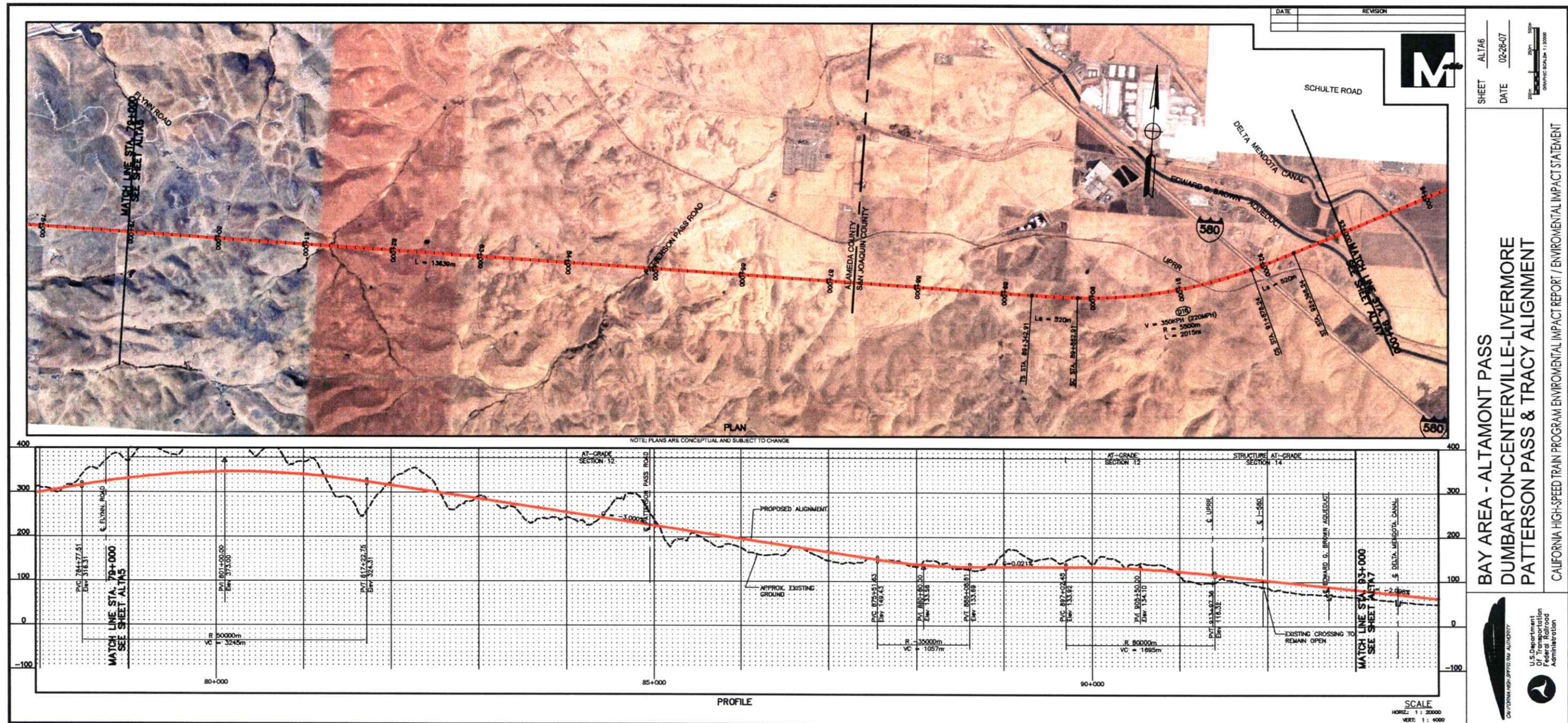
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U.S. Department of Transportation
Federal Railroad Administration

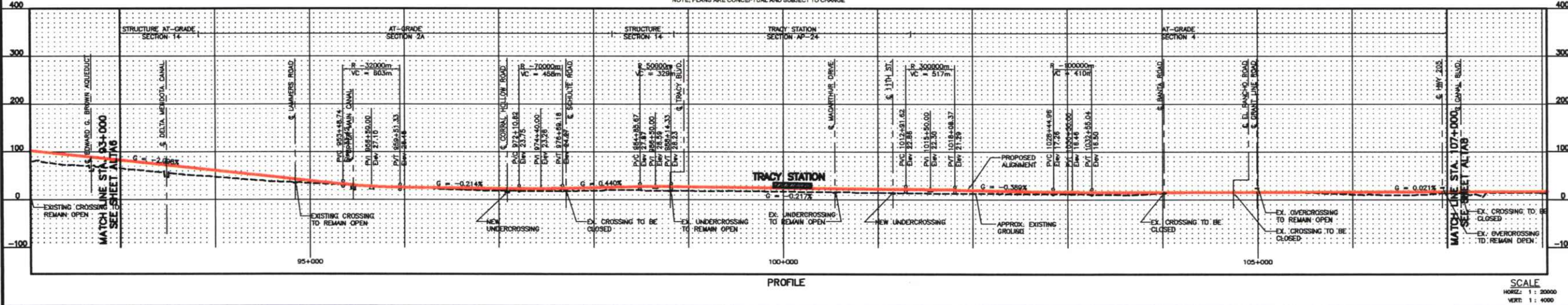
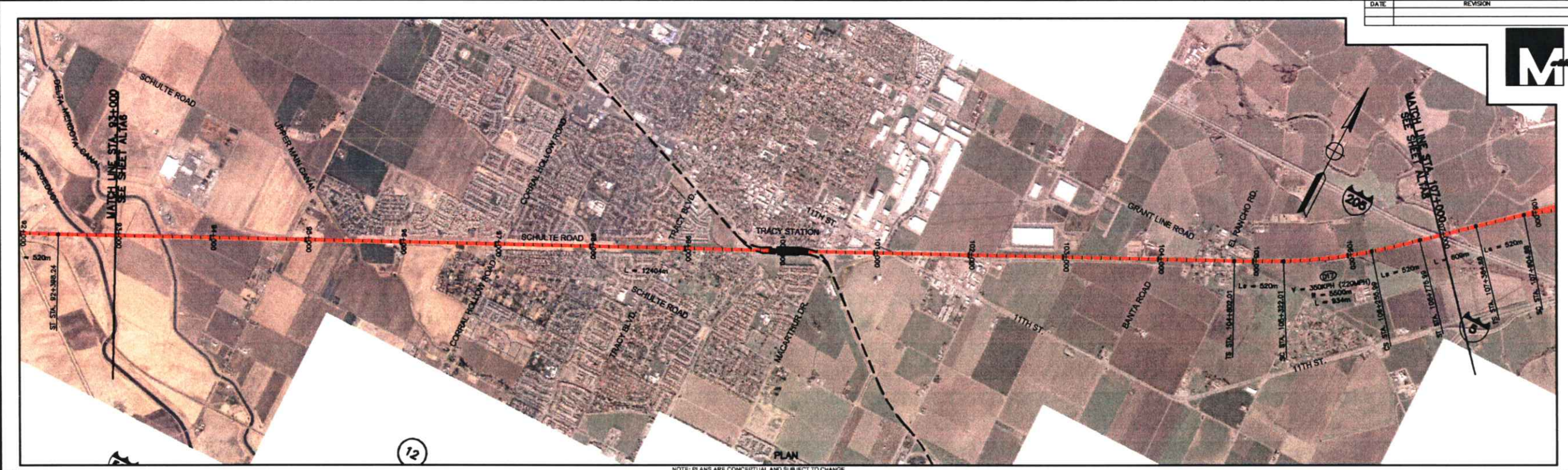
**BAY AREA - ALTAMONT PASS
DUMBARTON-CENTERVILLE-LIVERMORE
PATTERSON PASS & TRACY ALIGNMENT**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

SHEET ALT4
DATE 01-31-07



 CALIFORNIA HIGH-SPEED RAIL AUTHORITY	BAY AREA - ALTAMONT PASS DUMBARTON-CENTERVILLE-LIVERMORE PATTERSON PASS & TRACY ALIGNMENT		SHEET ALT-66 DATE 02-26-07
	CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT		U.S. Department of Transportation Federal Railroad Administration



BAY AREA - ALTAMONT PASS

DUMBARTON - CENTERVILLE - LIVERMORE

PATTERSON PASS & TRACY ALIGNMENT

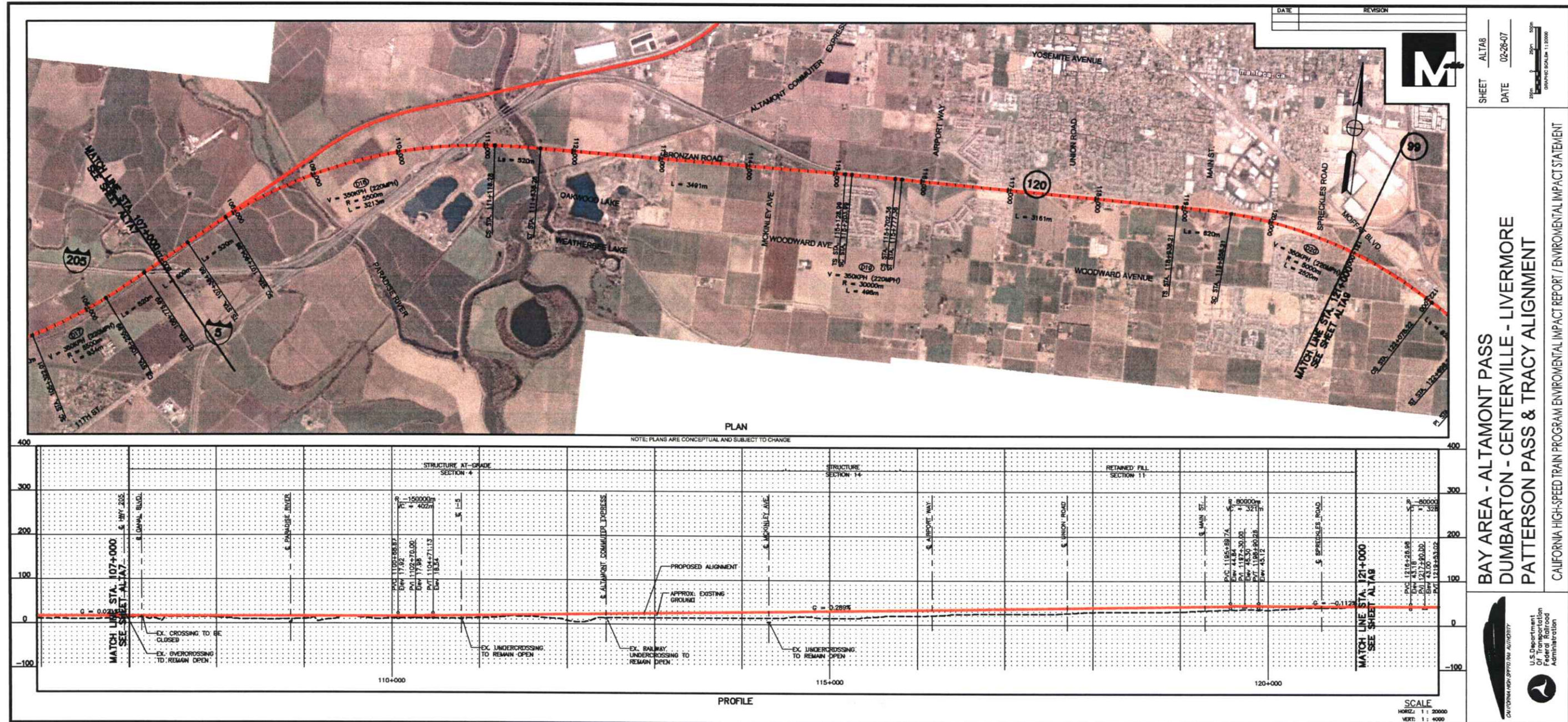
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

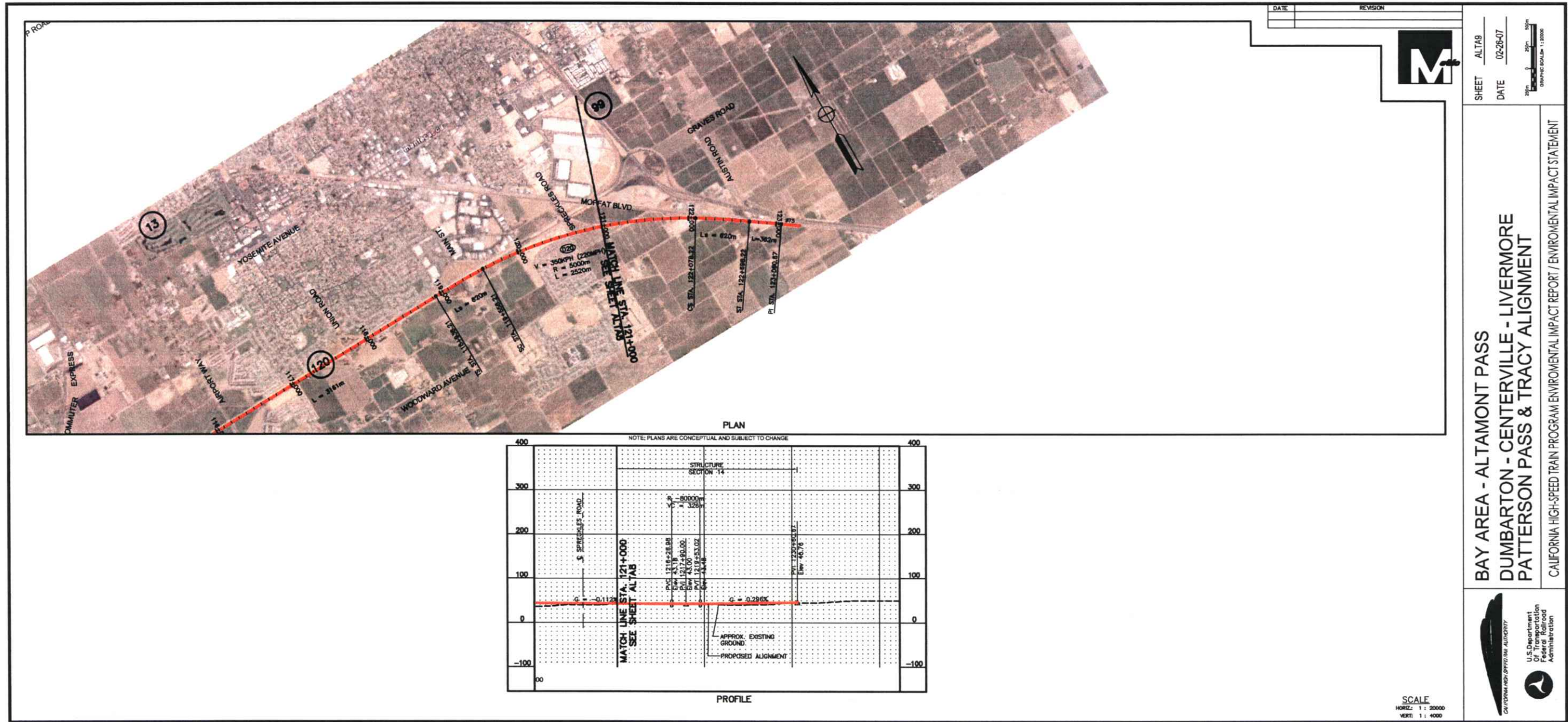
SHEET ALTAB

DATE 02-26-07

SCALE 1" = 2000'

1" = 4000'







DATE

REVISION

M

GRAPHIC SCALE: 1"=2000'

GRAPHIC SCALE: 1"=4000'

SHEET

ALTA50P2

DATE

02-27-07

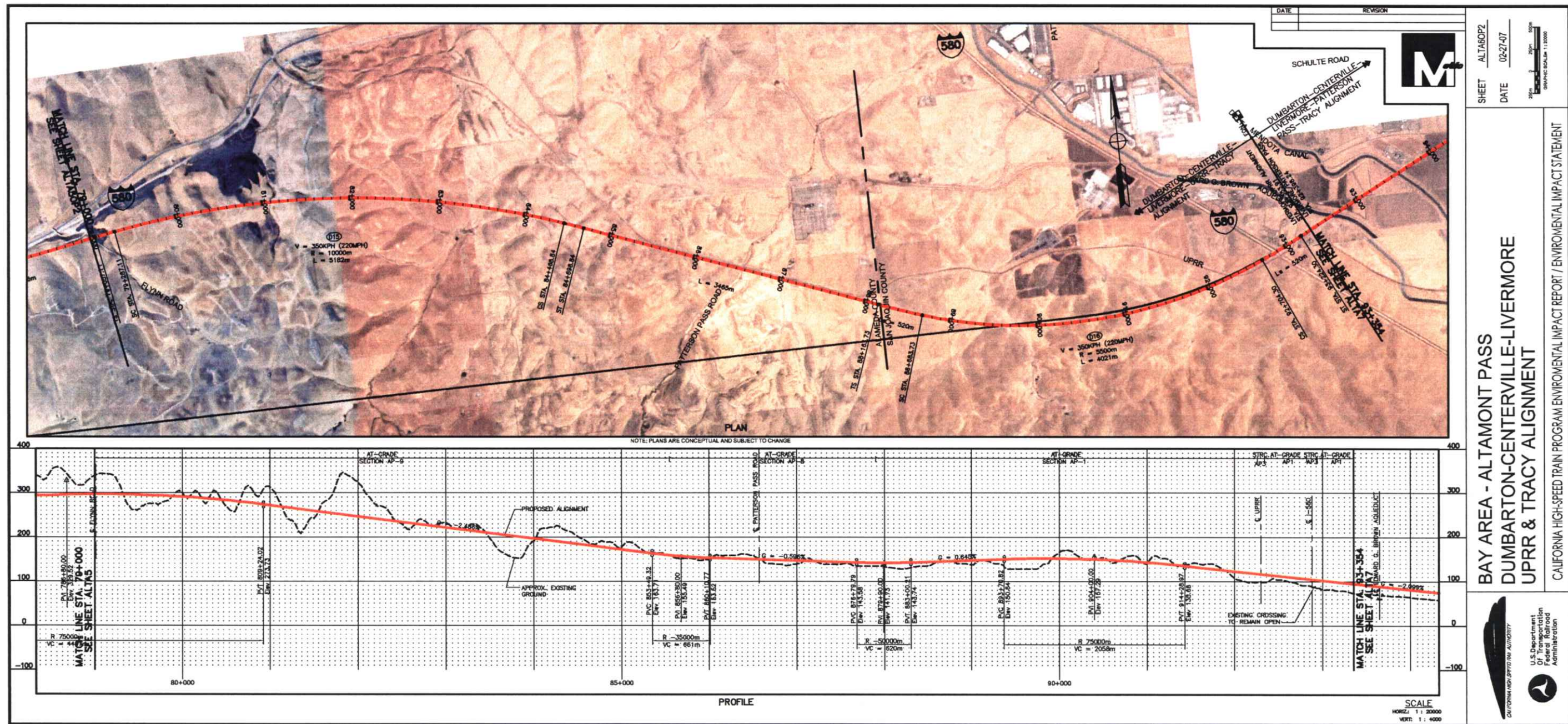
BAY AREA - ALTAMONT PASS

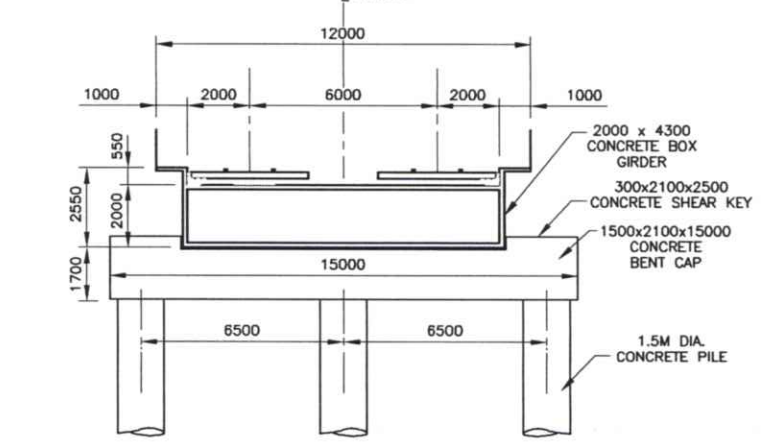
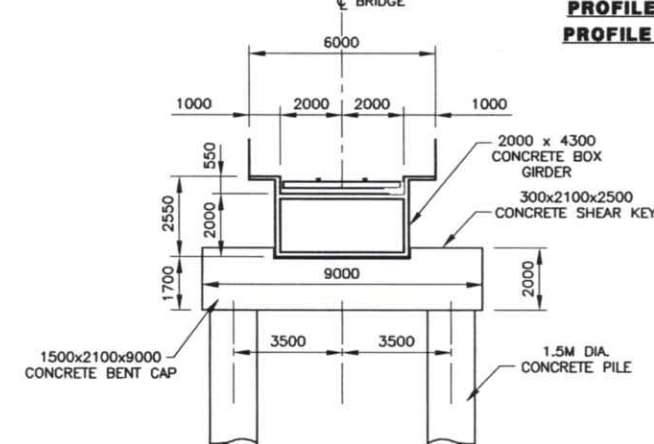
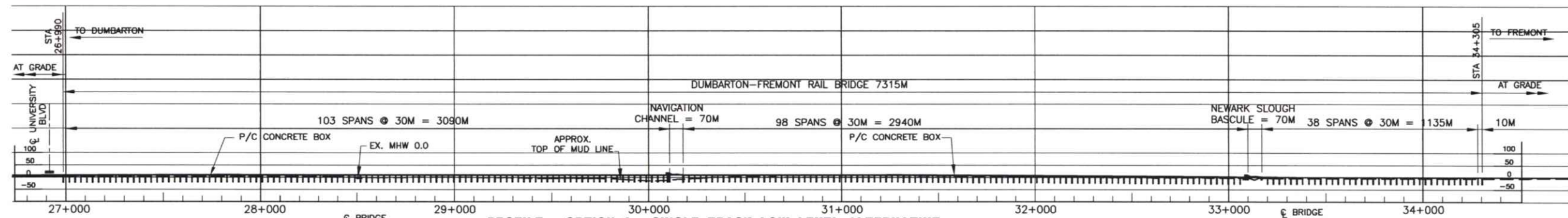
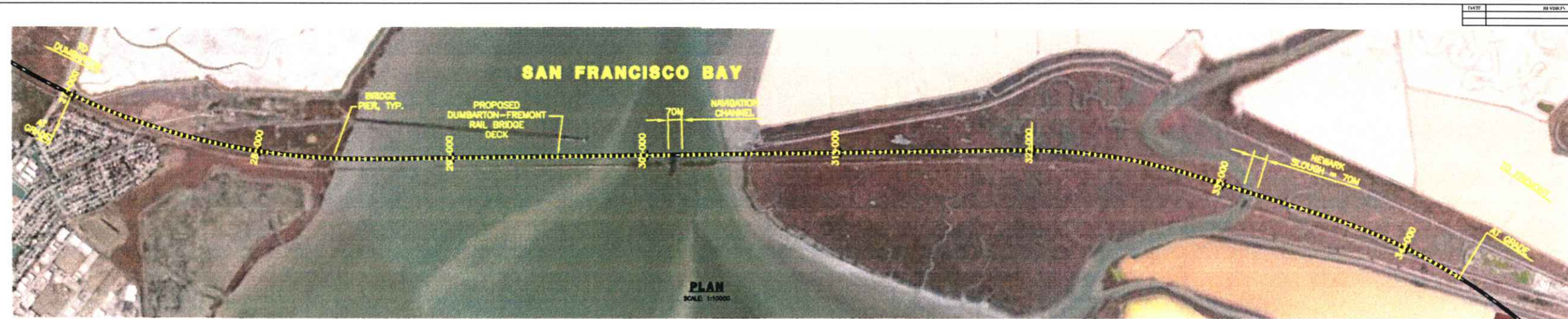
DUMBARTON-CENTERVILLE-LIVERMORE

UPRR & TRACY ALIGNMENT

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



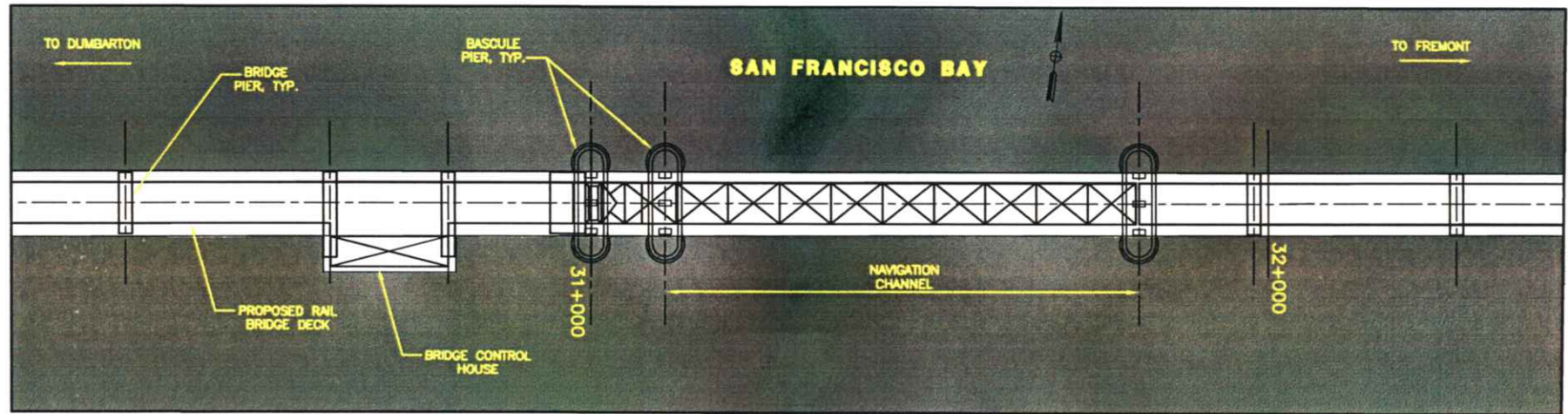


SHEET Dumbarton to Fremont
DATE 2-6-07

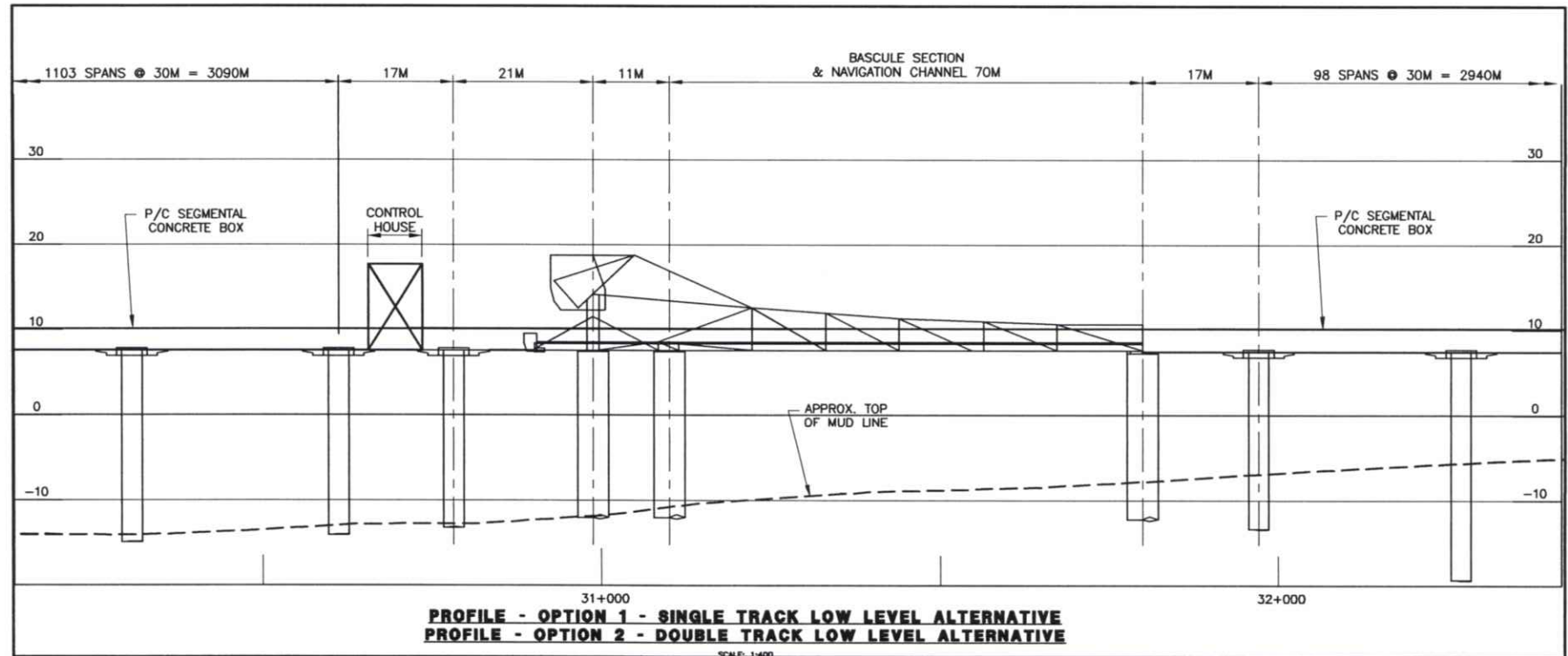
**CONCEPTUAL DESIGN BAY AREA
ALTA MONT PASS DUMBARTON - FREMONT
RAIL BRIDGE - OPT 1 & 2**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT





PLAN
SCALE: 1:400



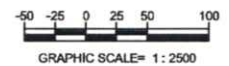
PROFILE - OPTION 1 - SINGLE TRACK LOW LEVEL ALTERNATIVE
PROFILE - OPTION 2 - DOUBLE TRACK LOW LEVEL ALTERNATIVE
SCALE: 1:400

DATE	REVISION

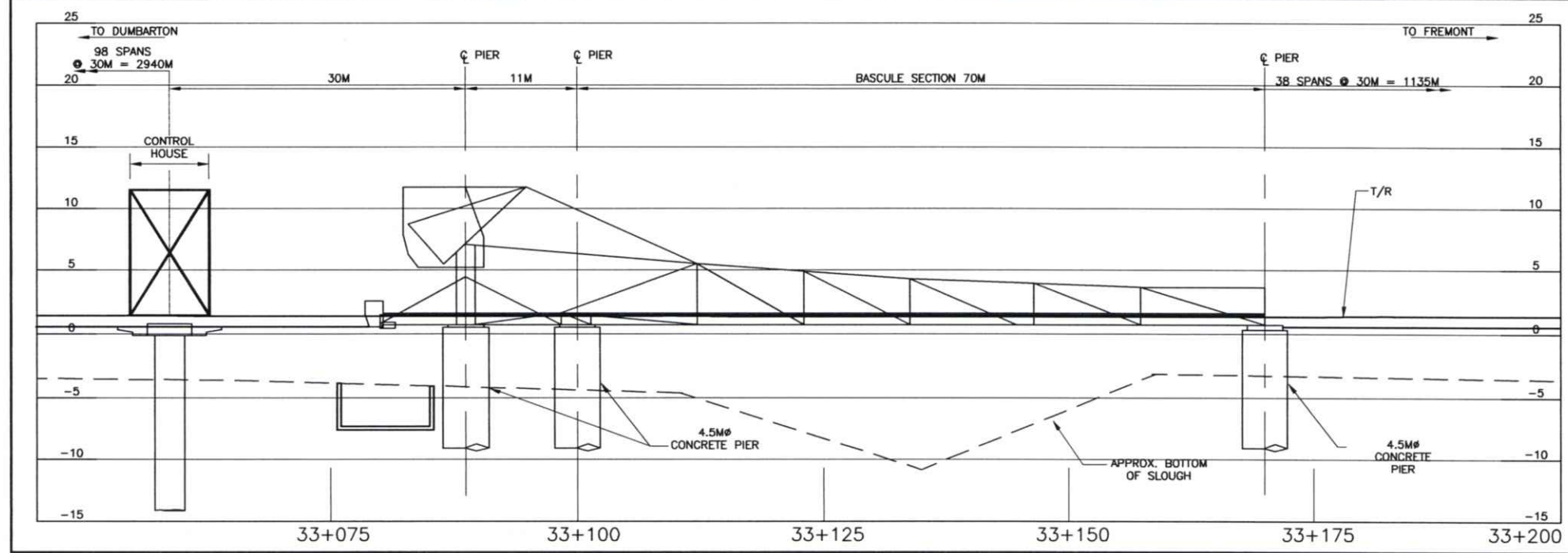
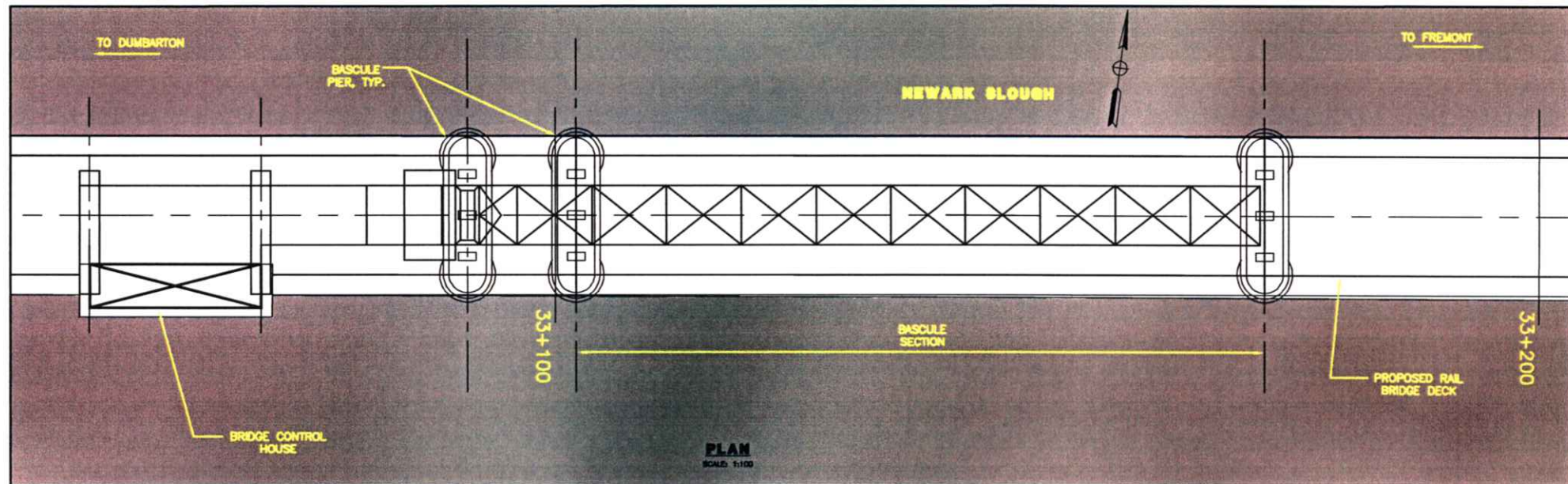
SHEET Dumbarton-1
DATE 2-4-07

**CONCEPTUAL DESIGN BAY AREA
ALTAMONT PASS DUMBARTON - FREMONT
RAIL BRIDGE OPT 1/2**

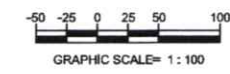
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



DATE	REVISION



PROFILE - OPTION 1/2 - LOW LEVEL ALTERNATIVE
SCALE: 1:100



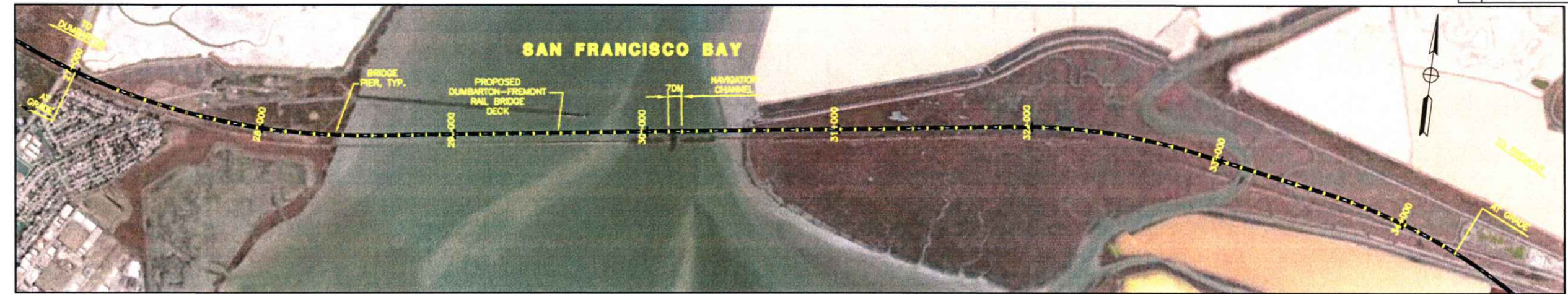
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DATE 2-4-07

**BAY AREA - ALTAMONT PASS
NEWARK SLOUGH BRIDGE-OPT 1/2
CONCEPTUAL DESIGN**

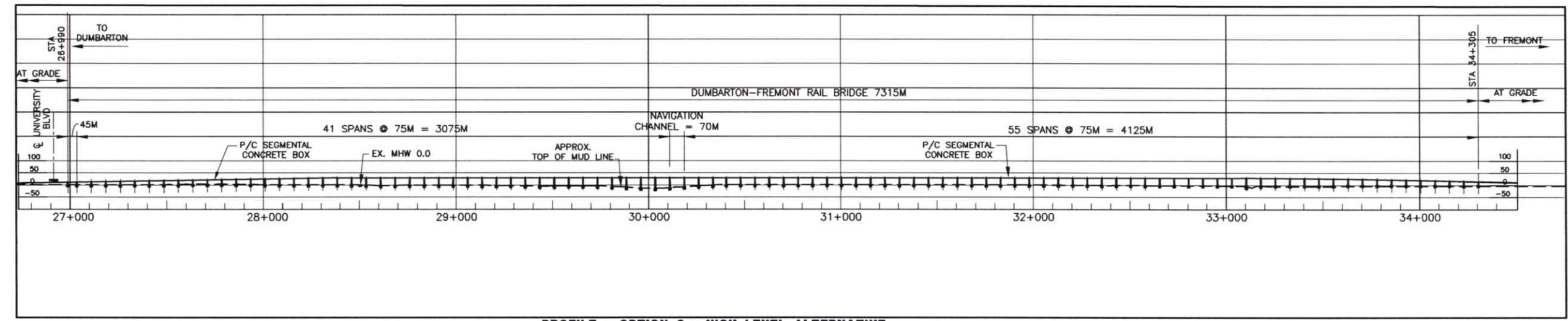
CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



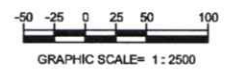
DATE	REVISIONS



PLAN
SCALE: 1:10000



PROFILE - OPTION 3 - HIGH LEVEL ALTERNATIVE
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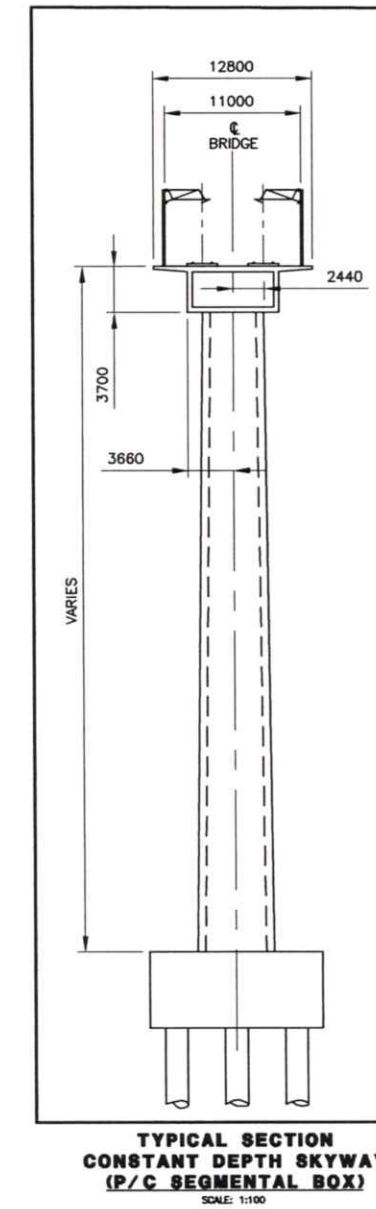
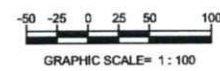
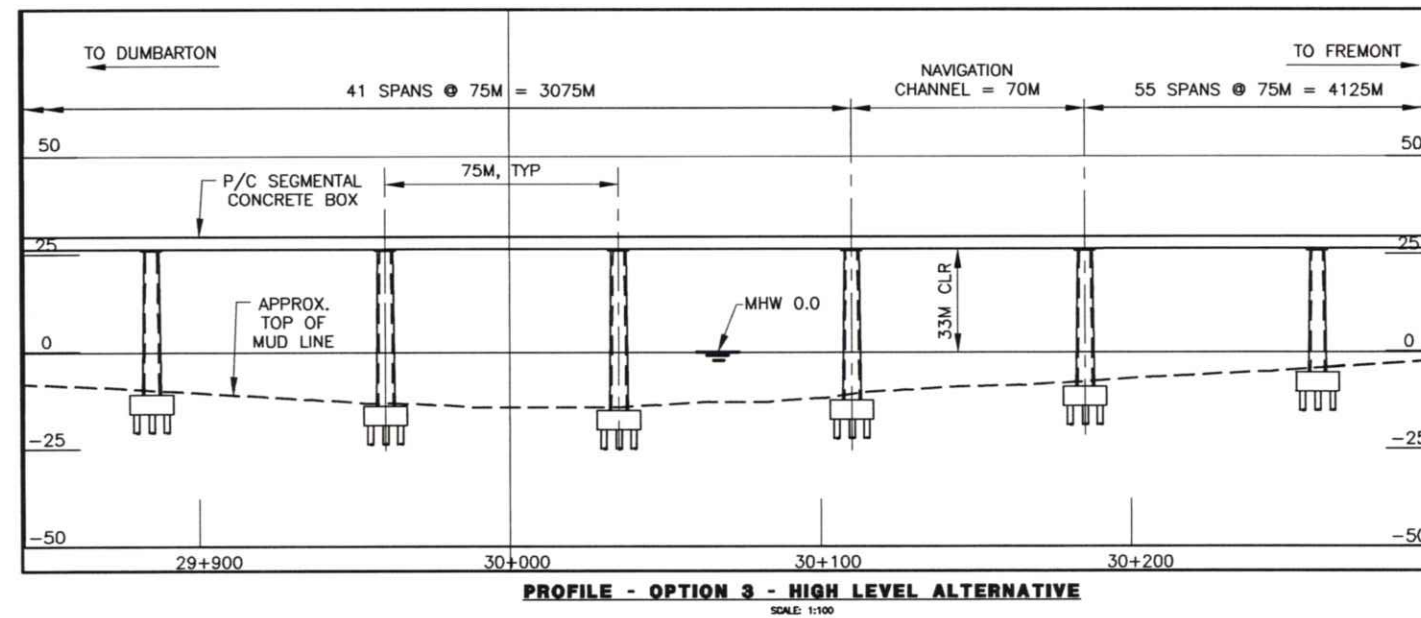
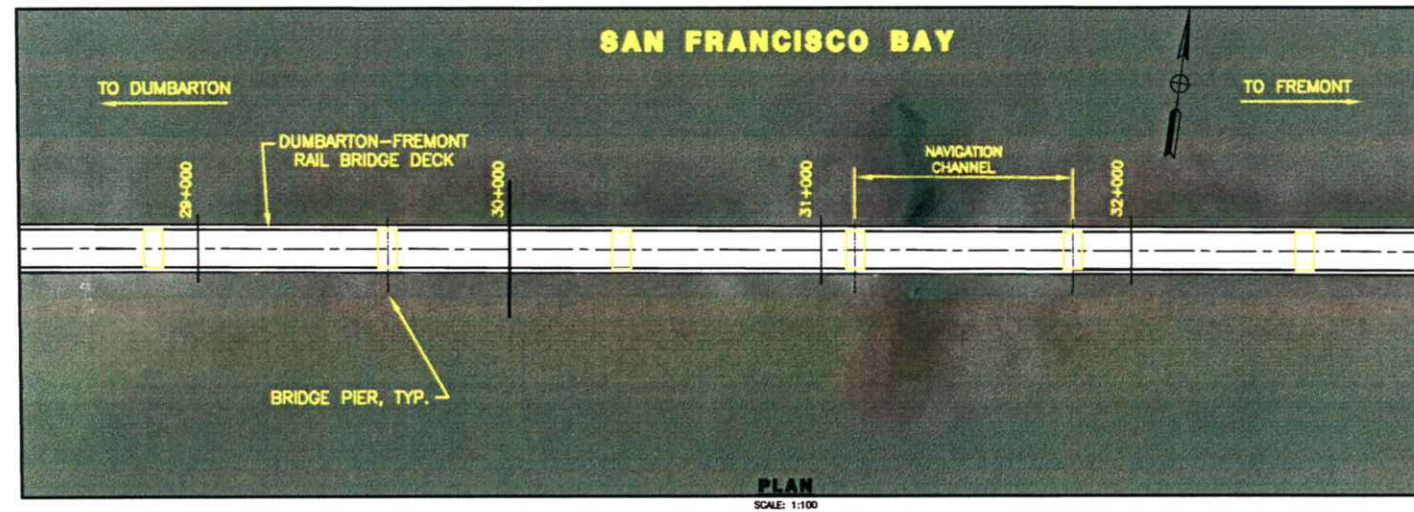


SHEET Dumbarton 24
DATE 2/6/07

**BAY AREA - ALTAMONT PASS
DUMBARTON - FREMONT RAIL BRIDGE - OPT 3
CONCEPTUAL DESIGN**

CALIFORNIA HIGH-SPEED TRAIN PROGRAM / ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT





DATE	REVISION

SHEET Dumbarton 2-2
DATE 2-6-07

BAY AREA - ALTAMONT PASS
DUMBARTON - FREMONT RAIL BRIDGE -OPT 3
CONCEPTUAL DESIGN

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT



Livermore BART connection to Isabel Station

As part of the Isabel Avenue Connectivity Station a BART extension is planned from the existing Dublin Pleasanton station in the median of I-580 to the UPRR corridor along Stanley Boulevard and Isabel Avenue. See sheet PLEAS1D and PLEYRD (for details).

The line extension starts in the median at the end of the existing tracks and continues in an at-grade fashion to the proposed revised interchange at El Charro Road. The BART tracks, on aerial structure, turn south down El Charro road using fairly sharp curves (50mph) staying within the existing highway right-of-way as much as possible to avoid impact on local development. The curves from the I-580 median to the El Charro Road median could be increased but would impact the local development slightly more. This should be reviewed during the next design phase. The line goes back to at-grade on the embankment between the quarry lakes to the UPRR alignment. The Station tracks are at-grade.

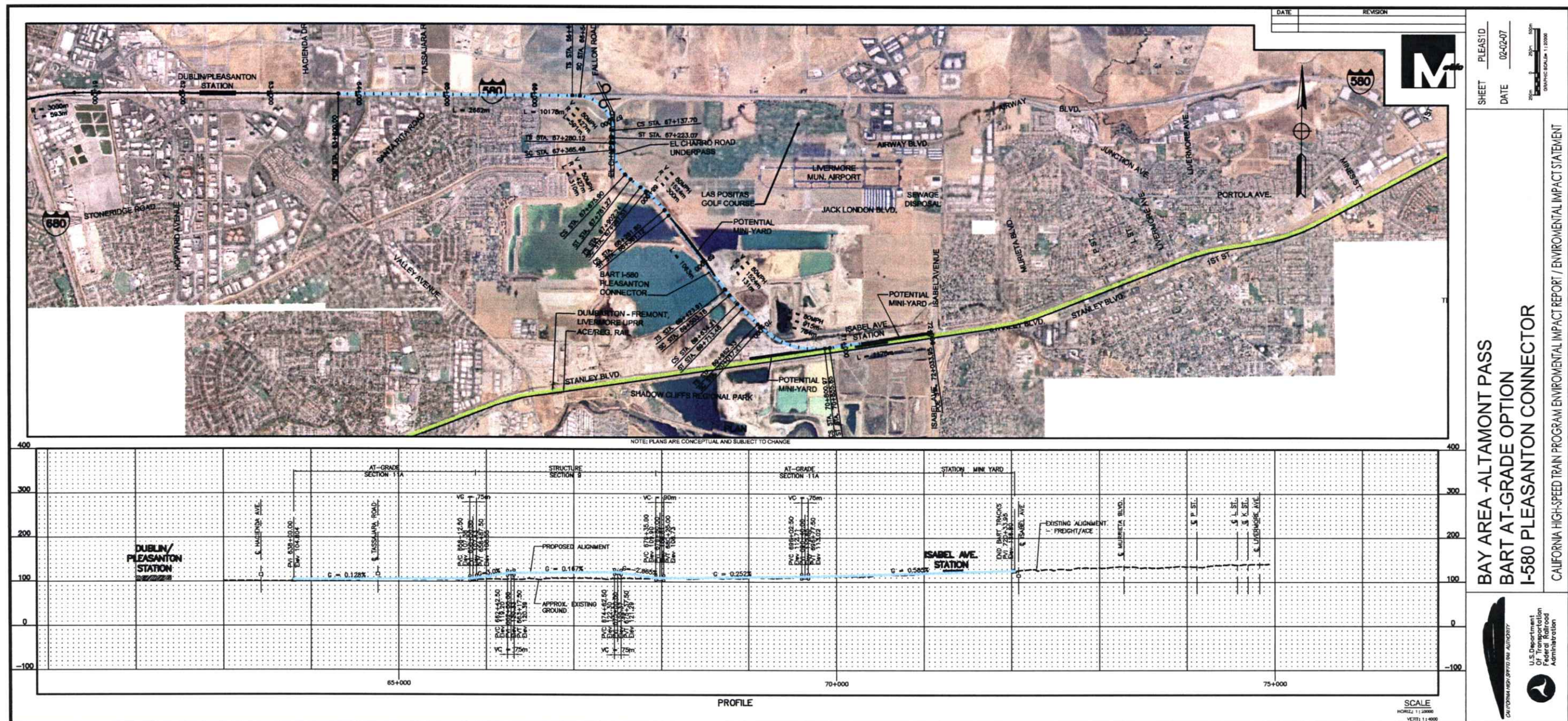
Three locations for a small layover / light maintenance yard have been identified. All of the yards have been shown with a minimum of three tracks at least two full trains long for a total storage of six trains at each location. The three locations are:

1. To the east of the end of the line Isabel station.
2. To the west of the end of the line Isabel station.
3. Along the embankment between the Quarry lakes.

The layover facility behind the station is needed in any case for normal BART operations. It is shown as a three track facility with a pocket track. A double crossover will be required behind (or in front of) the station to gain full access to and from all layover and station tracks. There is a potential for commercial and residential development directly adjacent to these layover tracks.

A potential mini-service yard to the west of the end of the line station could be constructed along the UPRR corridor as a dead end facility. The tracks could be as long as necessary or additional tracks added if required. The surrounding land use is rail corridors and quarry facilities. Small maintenance buildings could be shown alongside the tracks. BART train access would require a reverse move after exiting the passengers at the Isabel Station. Local road access would be from El Charro road from the west.

A third potential site is along the BART track embankment between the Quarry lakes. This is a double ended yard with access from both the Isabel Station end or from the existing Dublin/Pleasanton Station end. The tracks are limited in length to between the mainline curves. The surrounding land use is rail corridors and quarry facilities. Small maintenance buildings could be shown alongside the tracks. Local road access would be from Jack London Boulevard from the east.



BAY AREA - ALTAMONT PASS

BART AT-GRADE OPTION

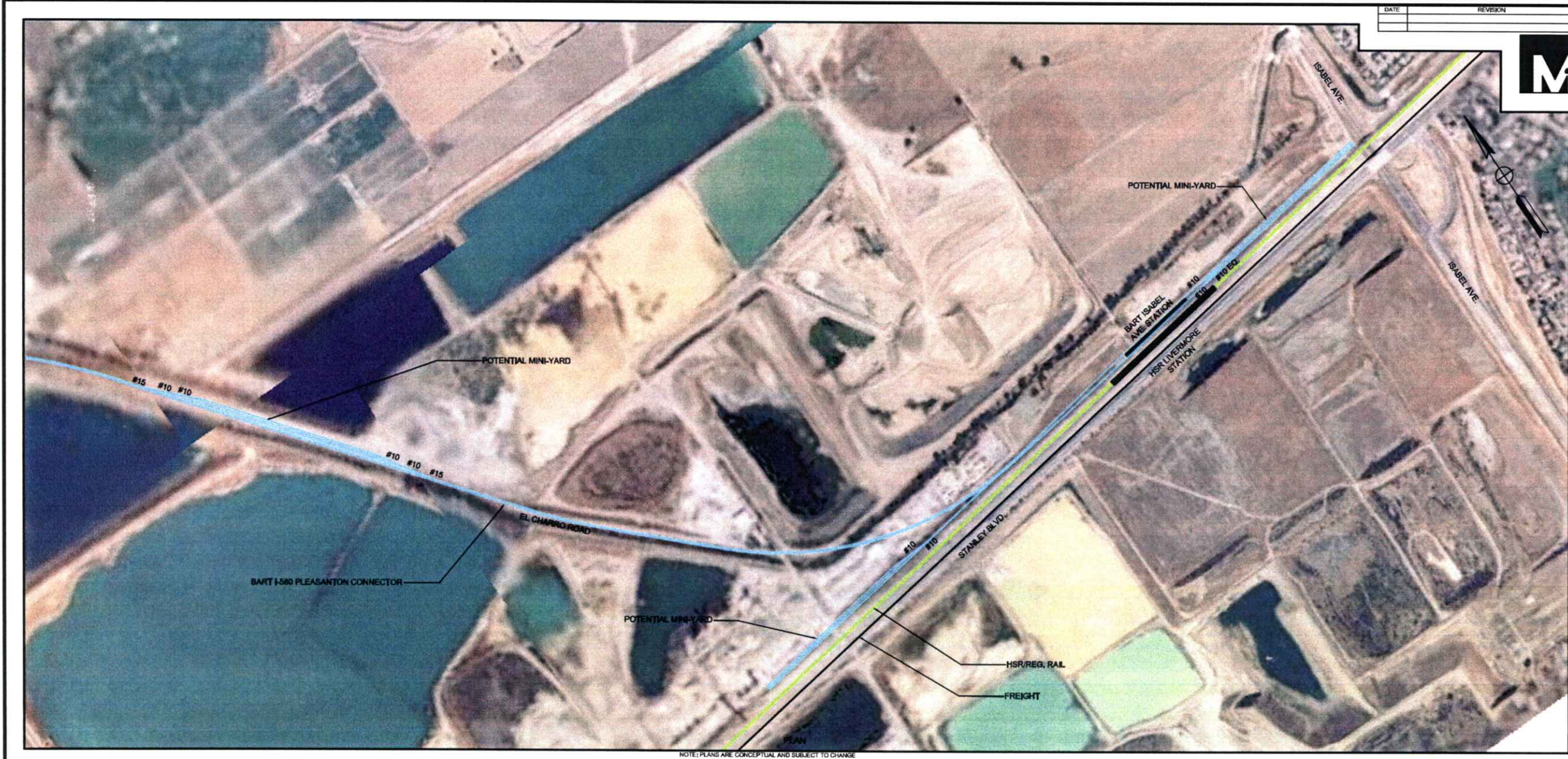
I-580 PLEASANTON CONNECTOR

CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

SHEET PLEAS1D

DATE 02-02-07

U.S. Department of Transportation
Federal Railroad Administration



NOTE: PLANS ARE CONCEPTUAL AND SUBJECT TO CHANGE

DATE	REVISION
03-02-07	

SHEET PLEVRO
DATE 03-02-07
GRAPHIC SCALE 1:2000
0 250m 500m

**BAY AREA -ALTA MONT PASS
BART AT-GRADE OPTION
POTENTIAL MINI-YARDS**

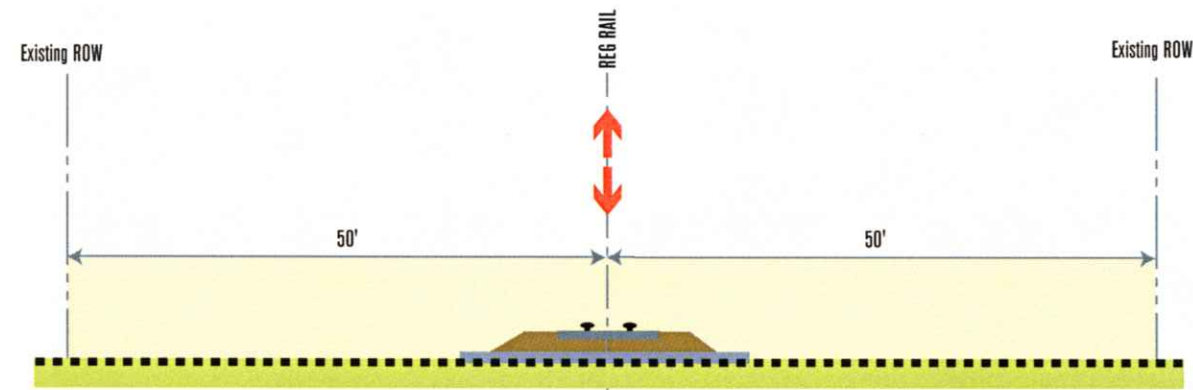


CALIFORNIA HIGH-SPEED TRAIN PROGRAM ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL IMPACT STATEMENT

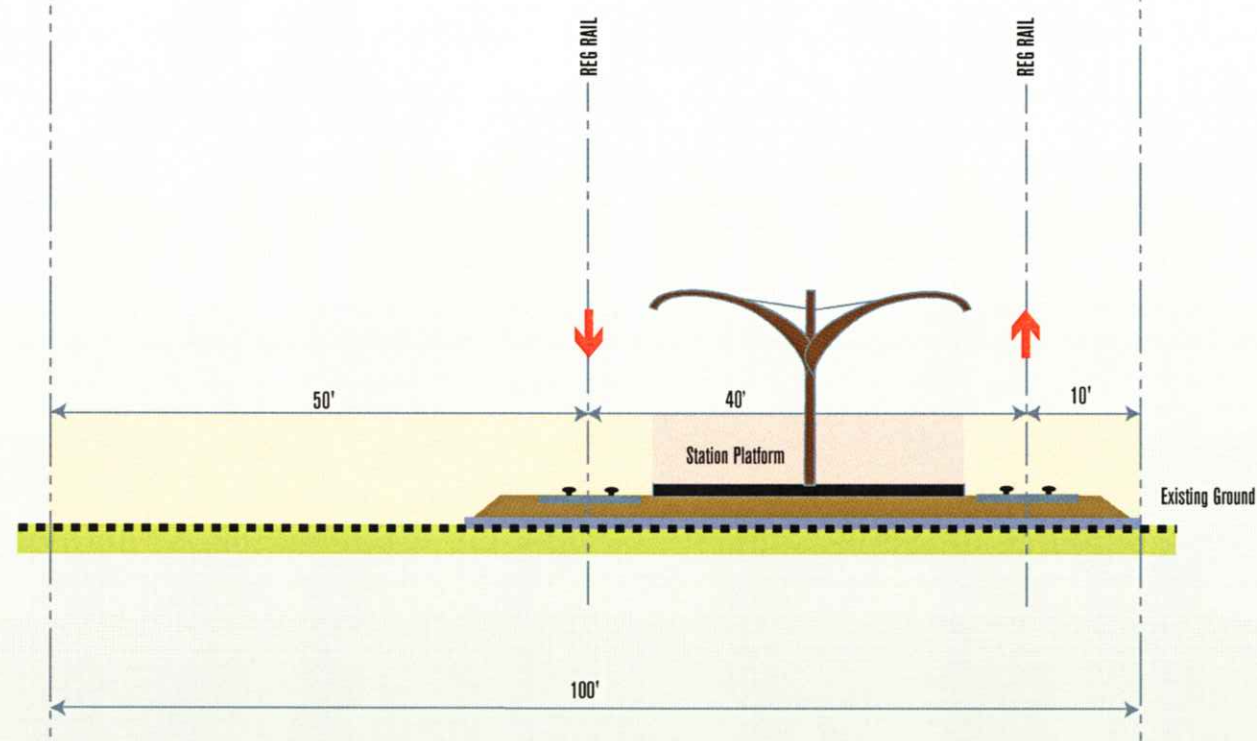
Appendix – Typical Sections

Index

Section 1 - Single track with two track stations
Section 2 - Double track with two track stations
Section 2.1 - Electrified double track with two track stations
Section 3 – Triple track with two track station
Section 4 – Four track; freight with electrified passenger and a two track station
Section 5 – Four track; freight with standard passenger and a two track station
Section 6 - Double track freight with standard passenger in Niles Canyon
Section 7 – Four track; two track freight with two track electrified passenger in tunnel through Niles Canyon
Section 8 - Electrified double track with freight tracks on separate corridor
Section 9 – BART in I-680 median; aerial structure and subway
Section 10 - Electrified double track with two track stations on aerial structure
Section 11 – Retained passenger (standard or electrified) double track in highway median
Section 11.1 – Retained BART in median
Section 12 - Electrified double track; at grade
Section 13 - Electrified double track in subway
Section 14 - Electrified double track on aerial structure

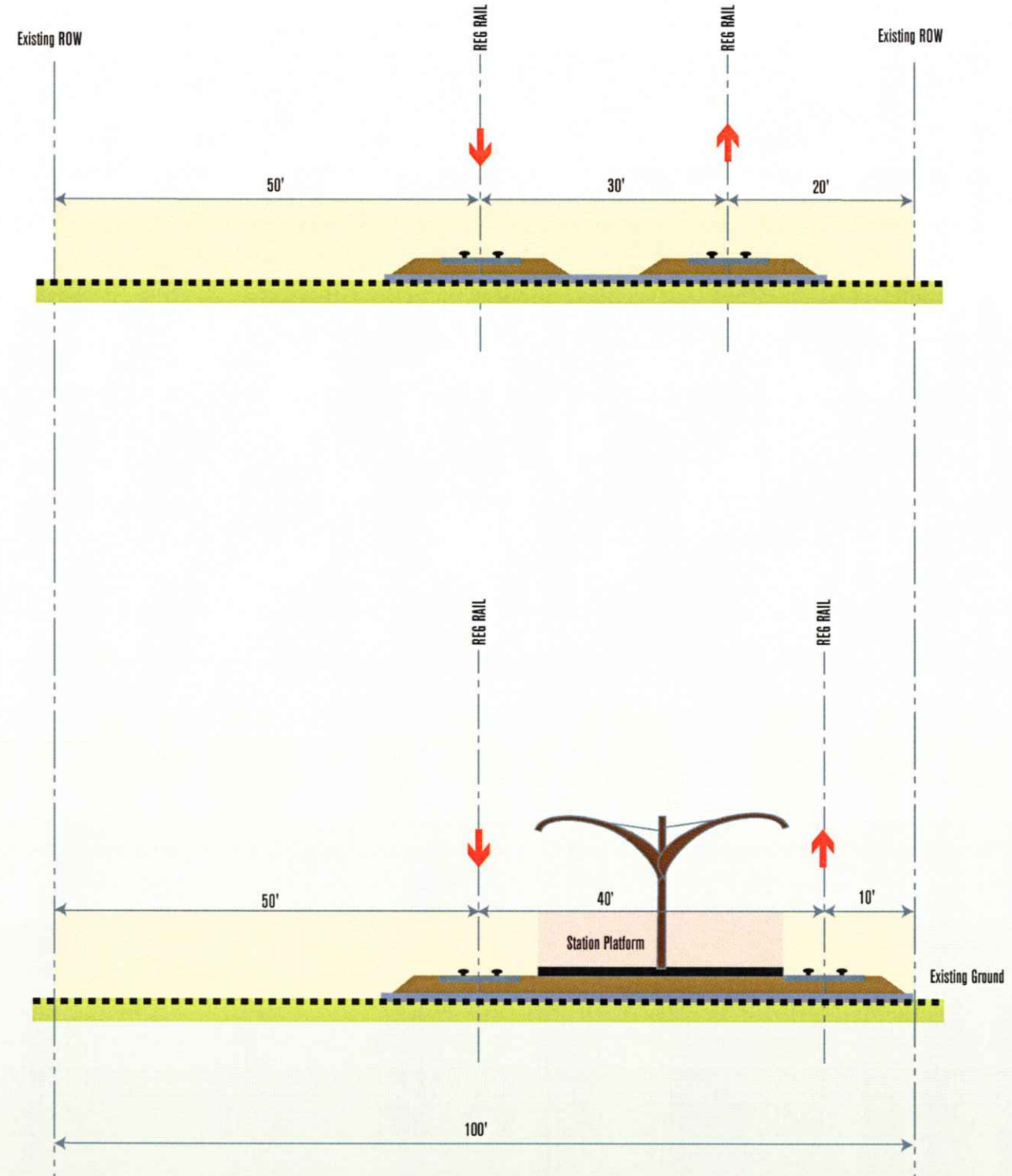


1 Track Section



2 Track Section at Station

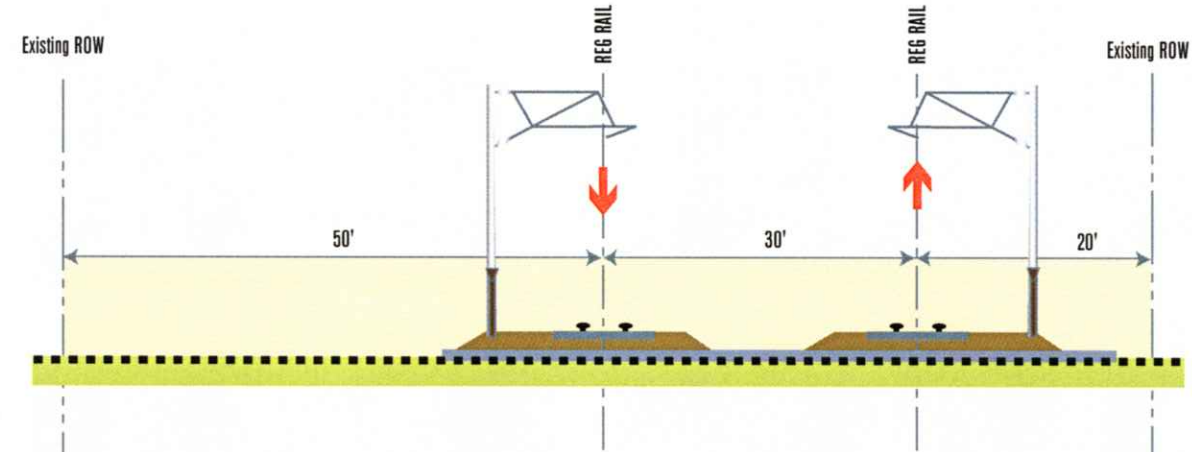
SECTION 1



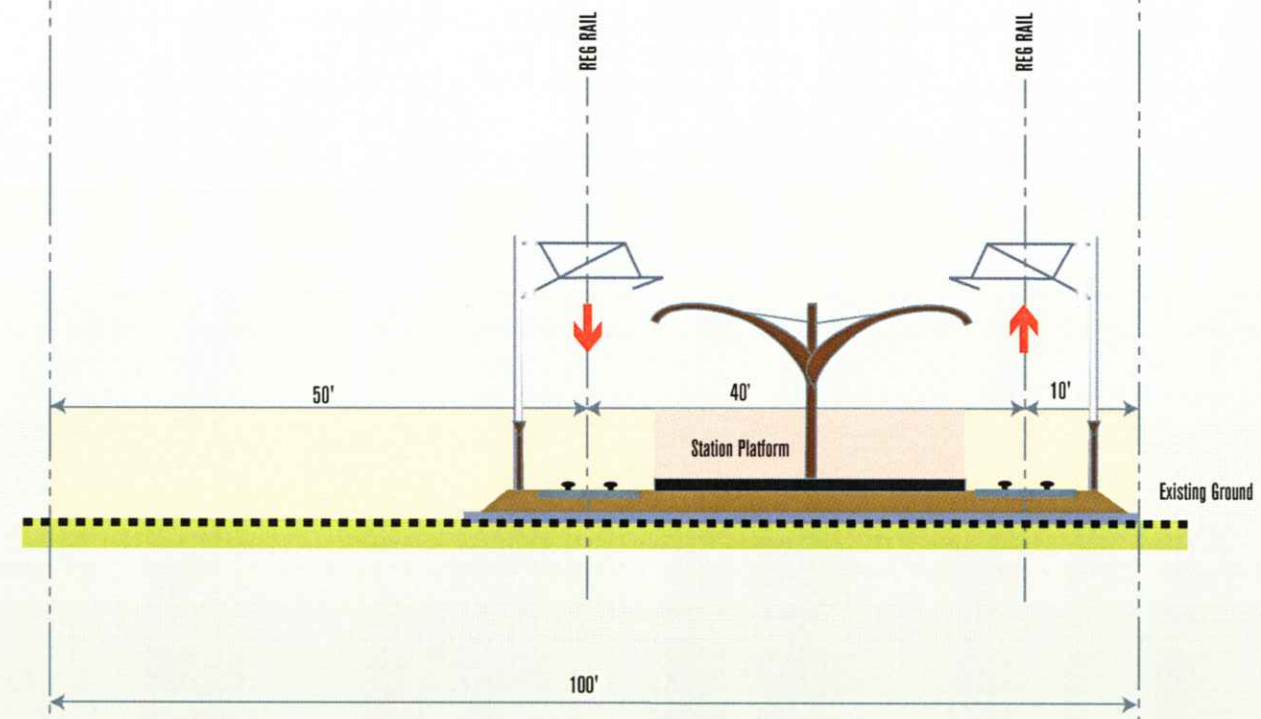
2 Track Section

2 Track Section at Station

SECTION 2

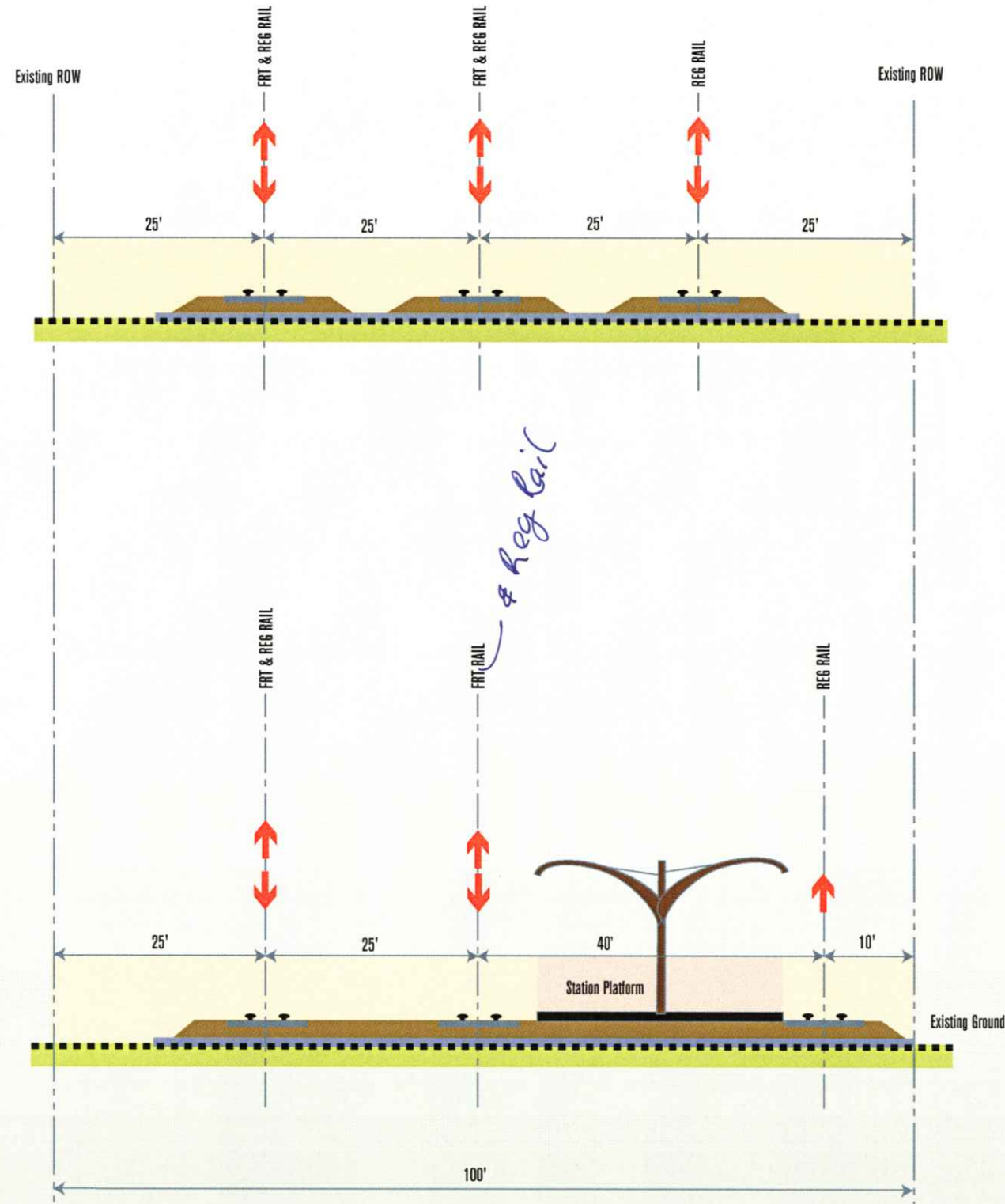


2 Track Section



2 Track Section at Station

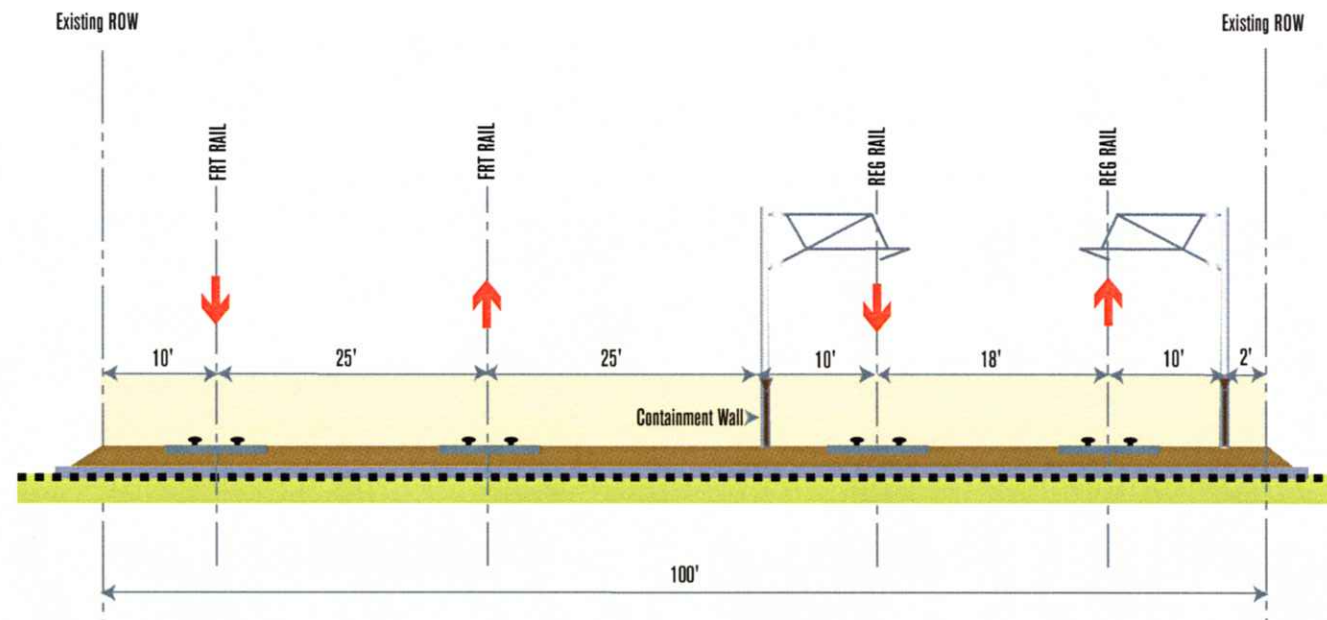
SECTION 2.1



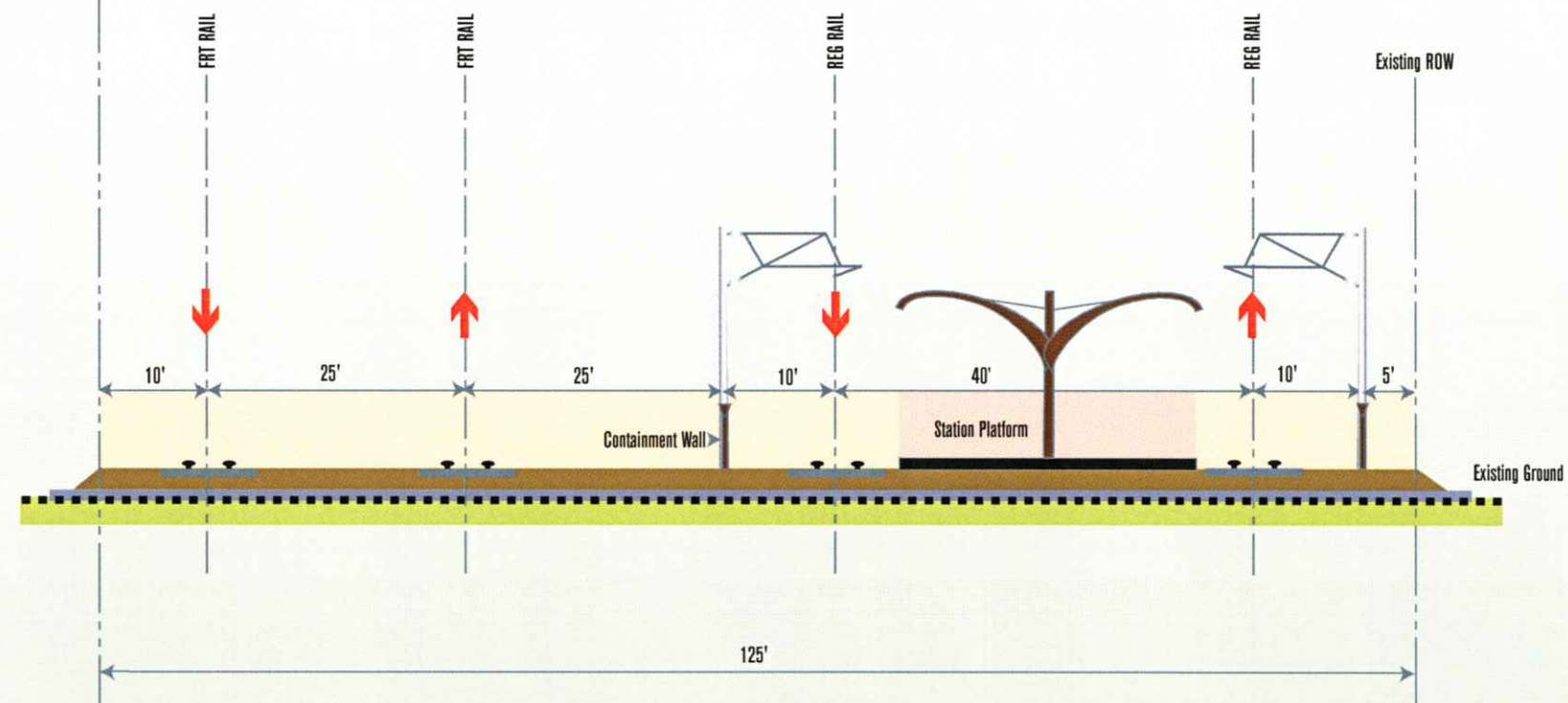
3 Track Section

3 Track Section at Station

SECTION 3

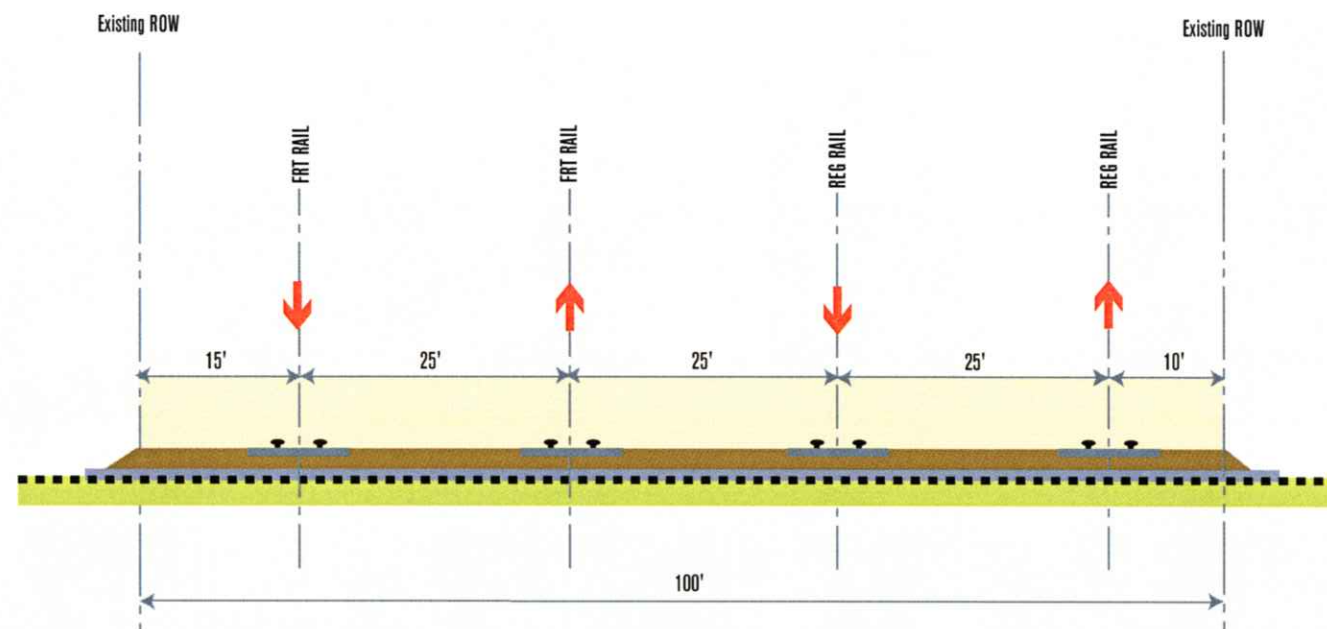


**4 Tracks at Grade
(Electrified Passenger)**

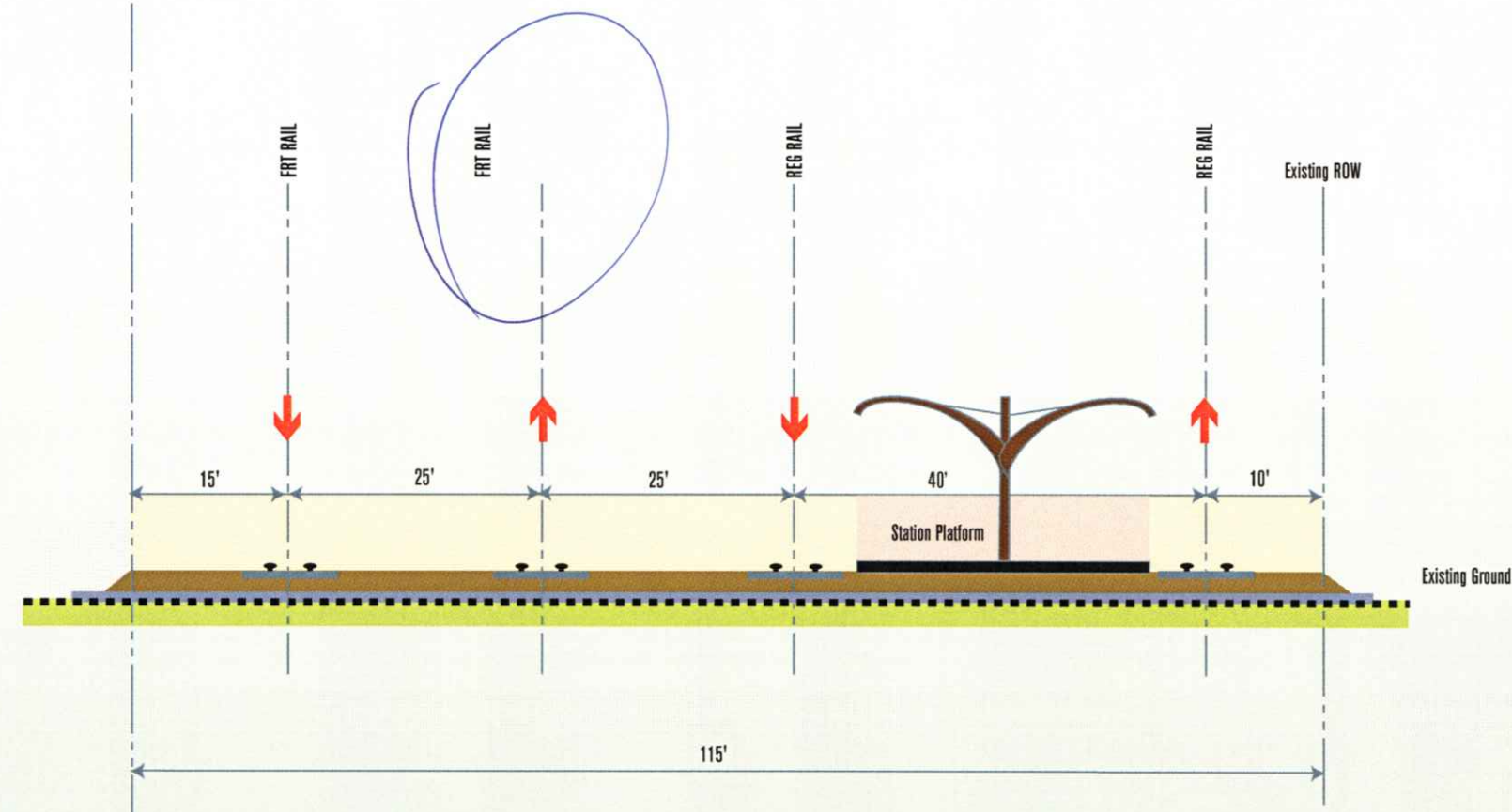


4 Track Section at Station

SECTION 4

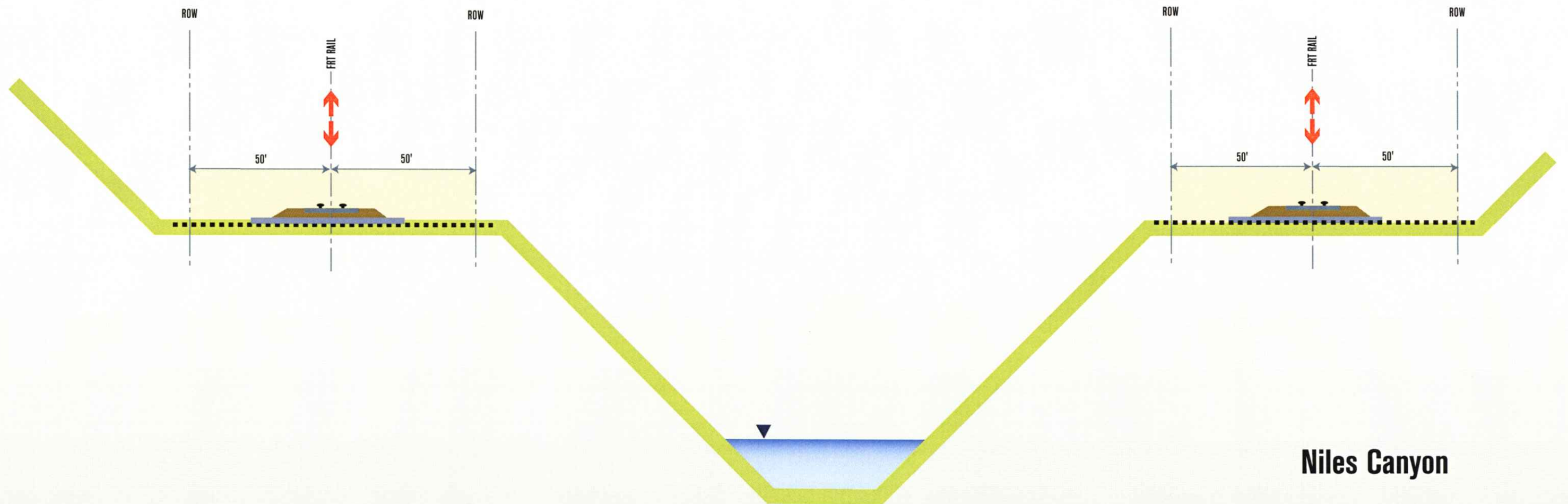


**4 Tracks at Grade
(Standard Passenger)**



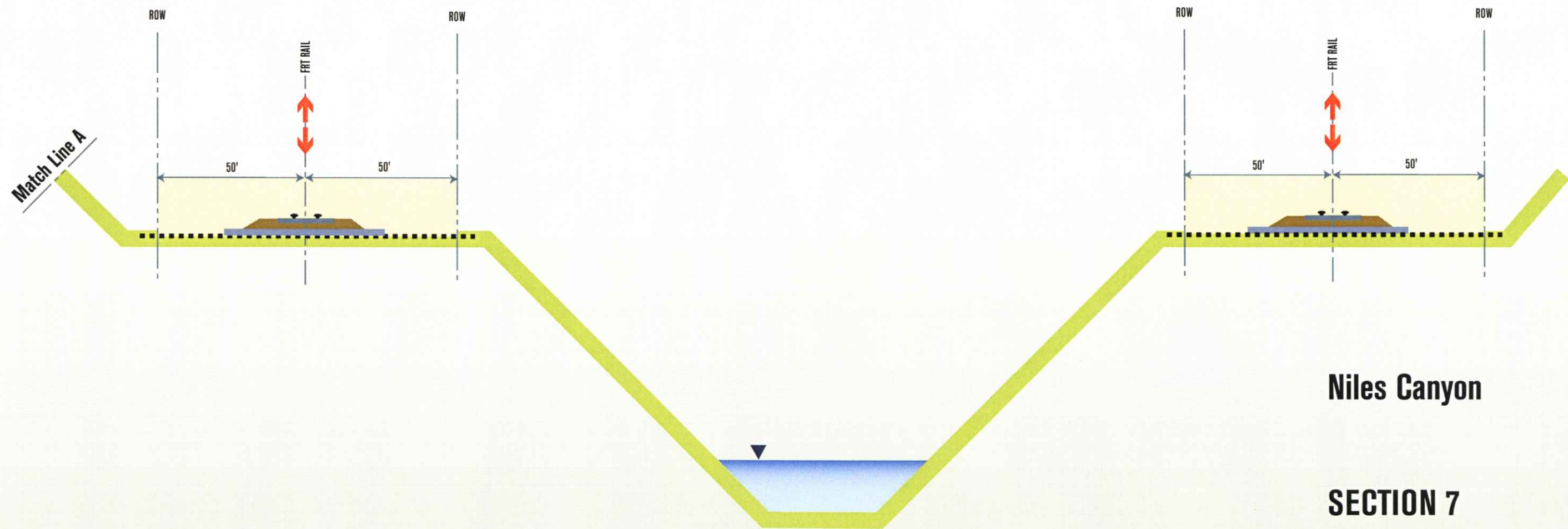
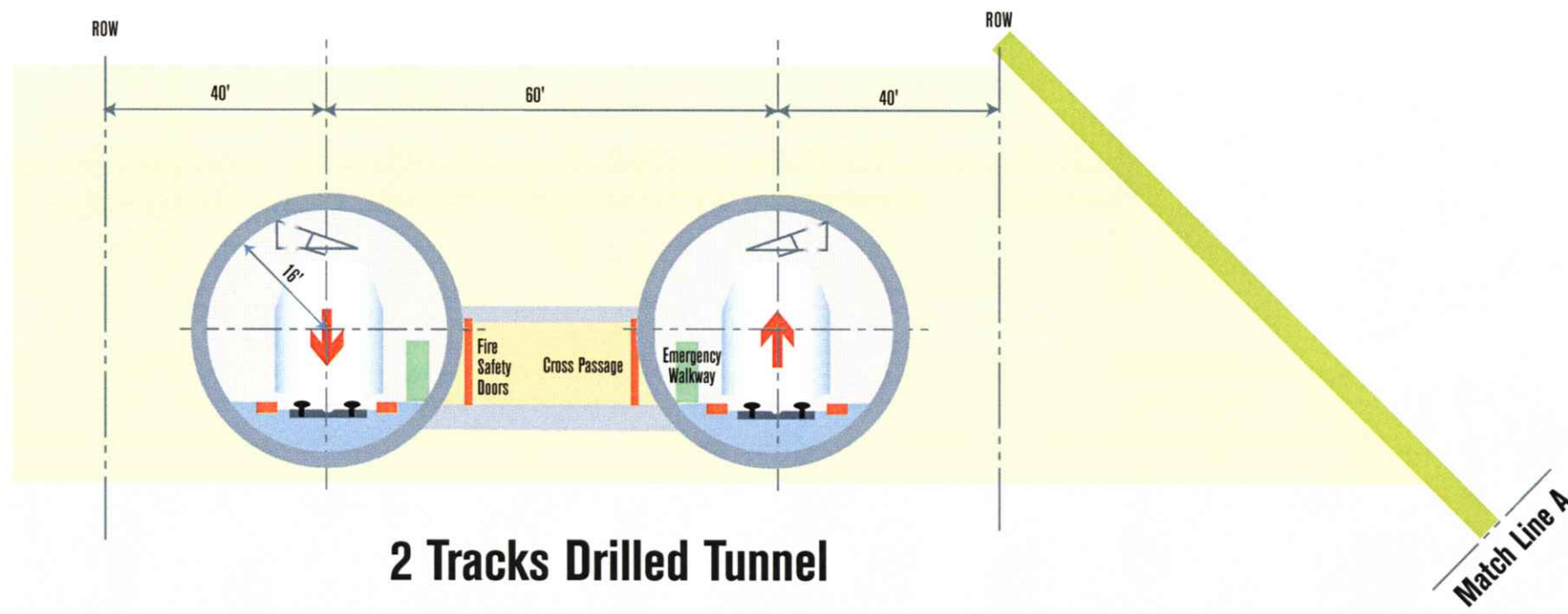
4 Track Section at Station

SECTION 5

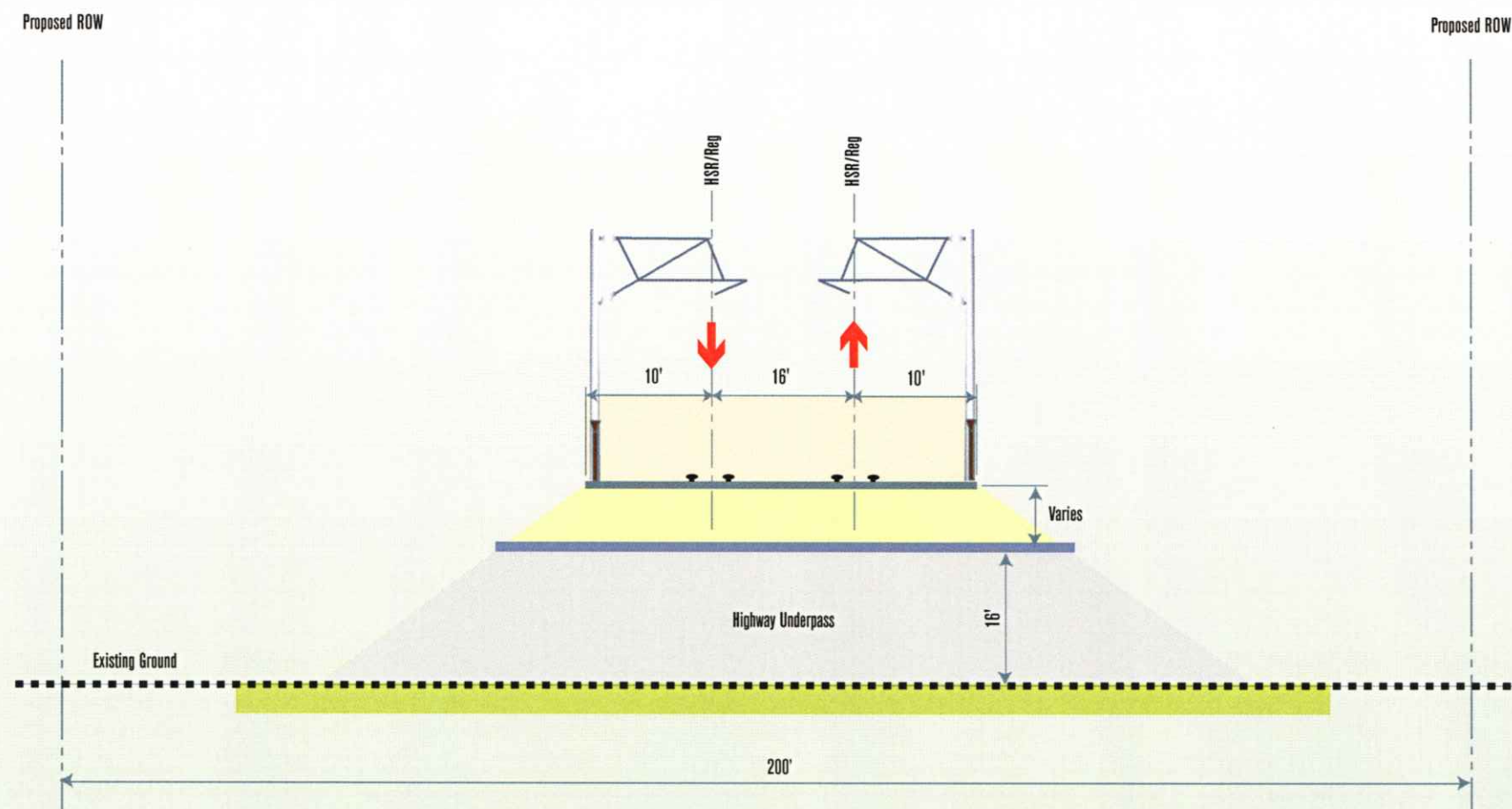
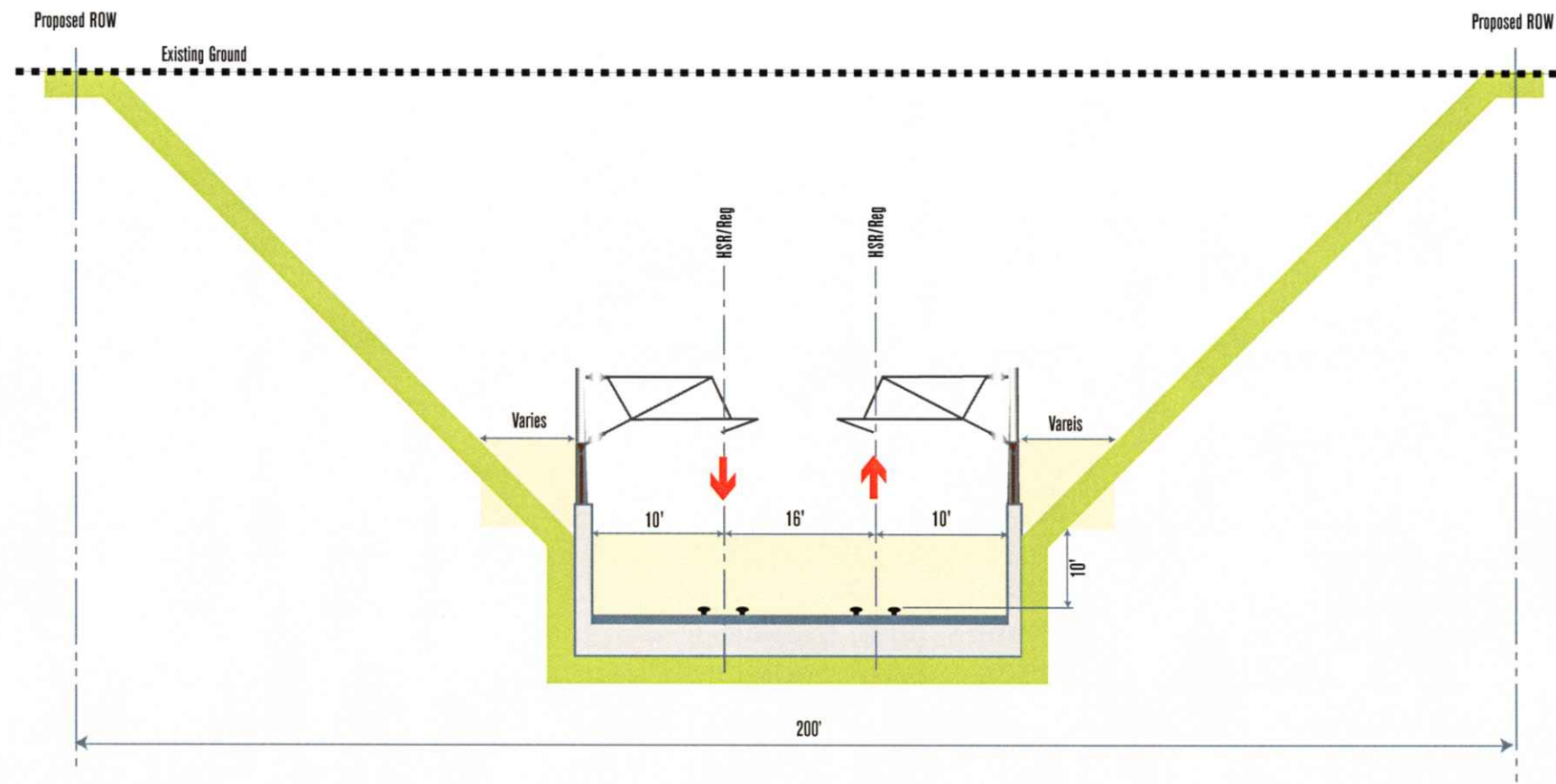


Niles Canyon

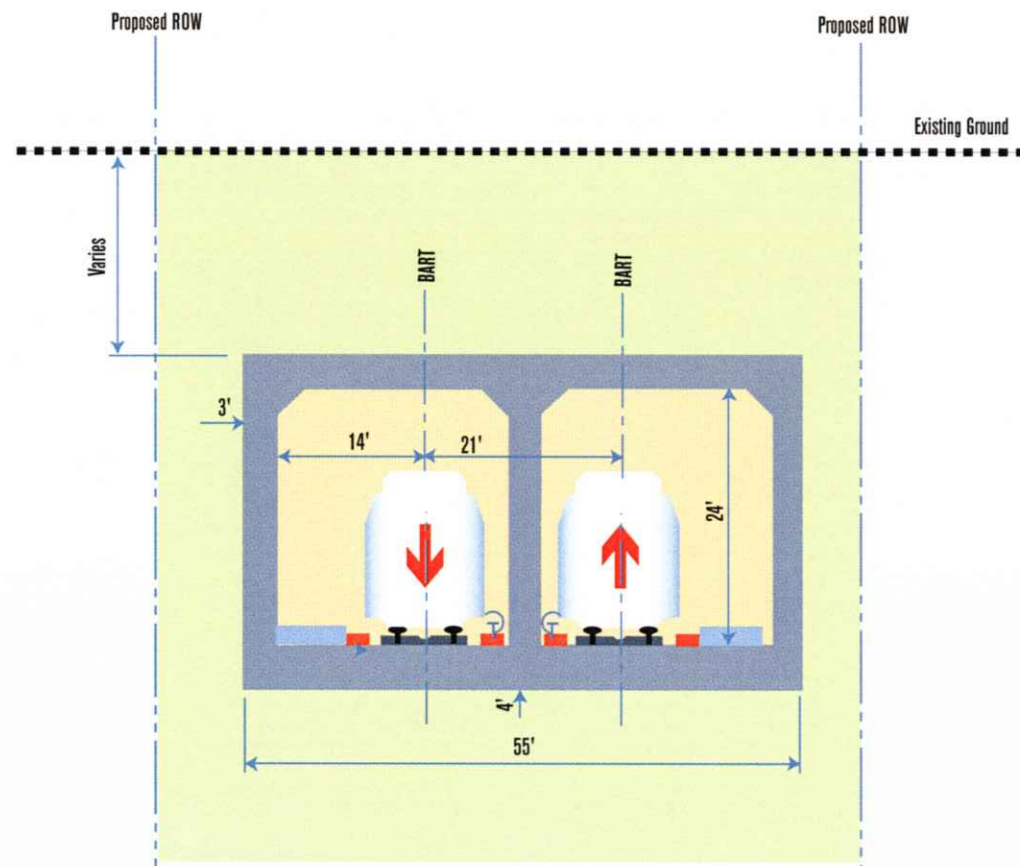
SECTION 6



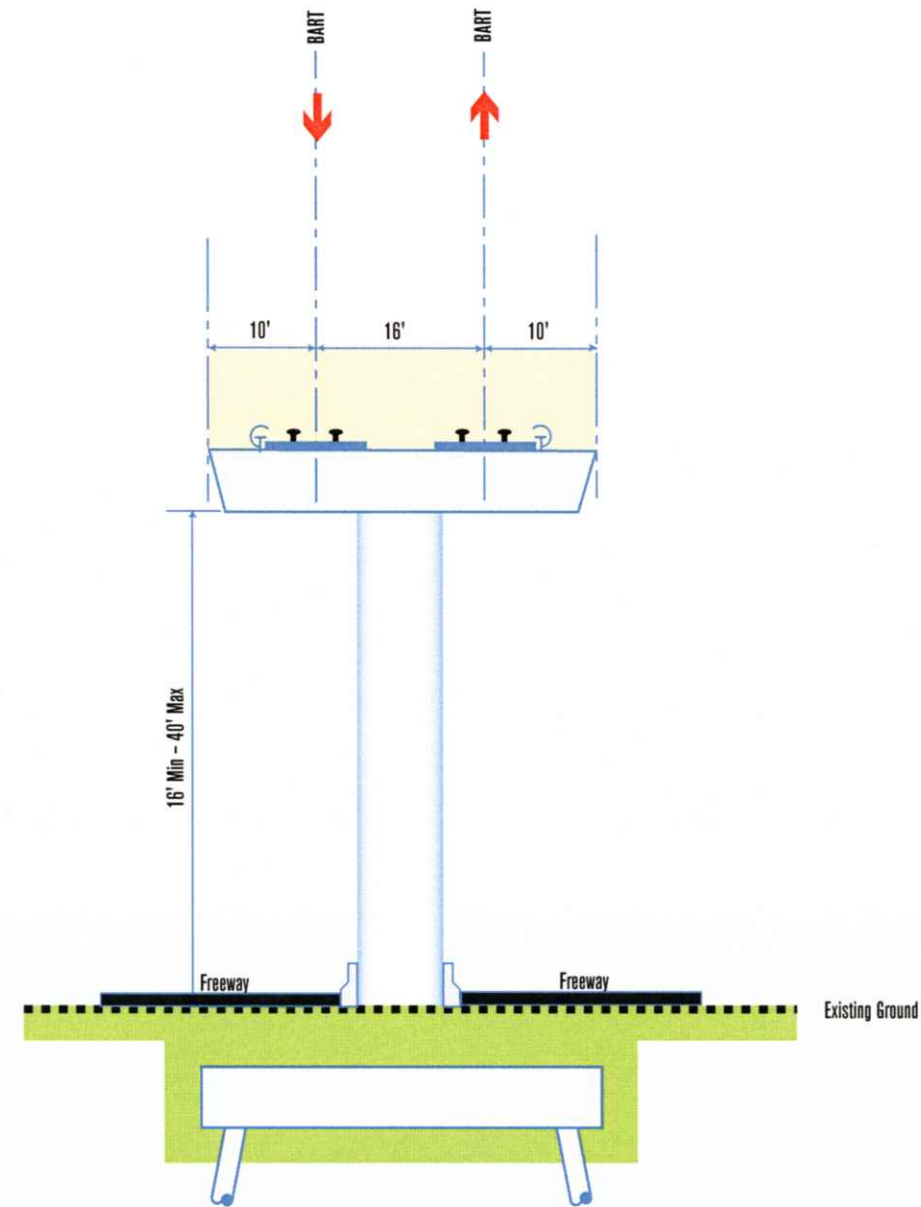
SECTION 7



SECTION 8

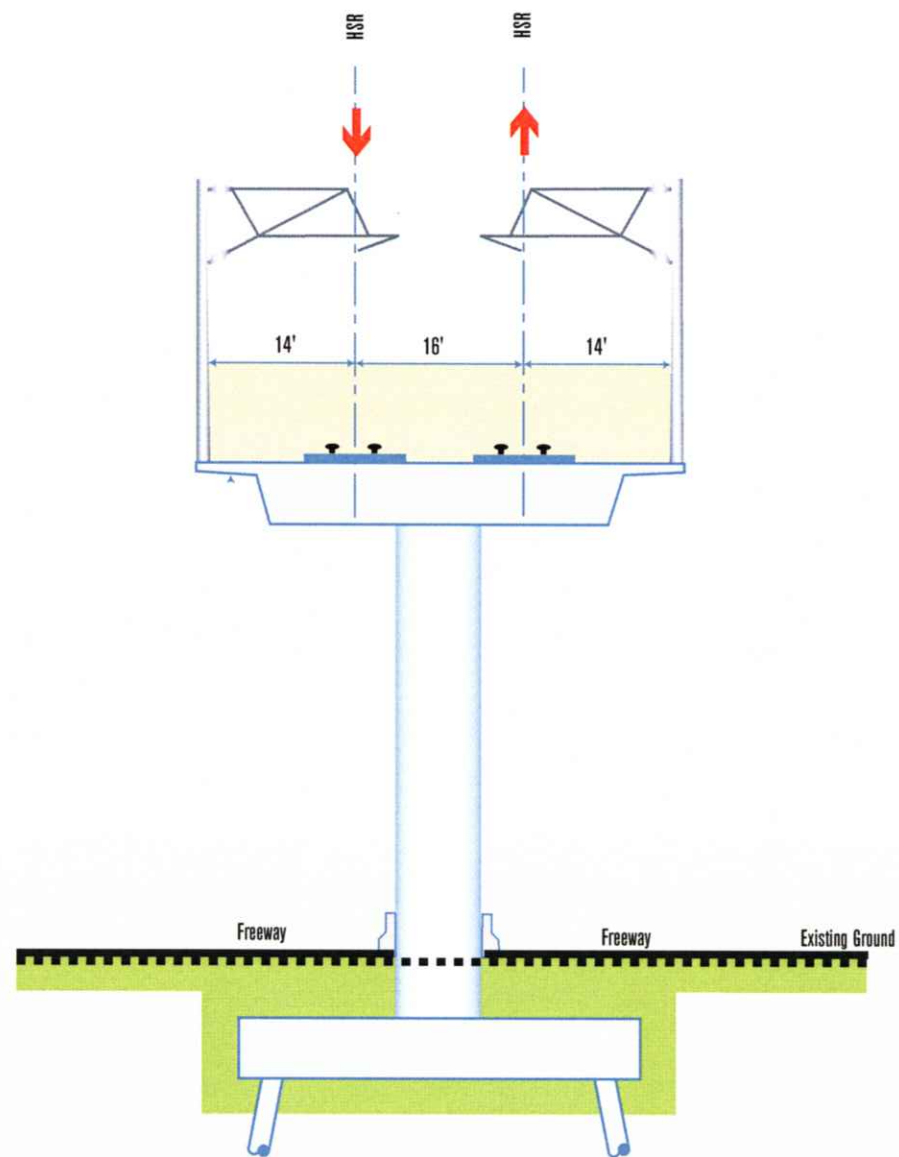


**2 BART Tracks Cut and Cover
In Iron Horse Trail**

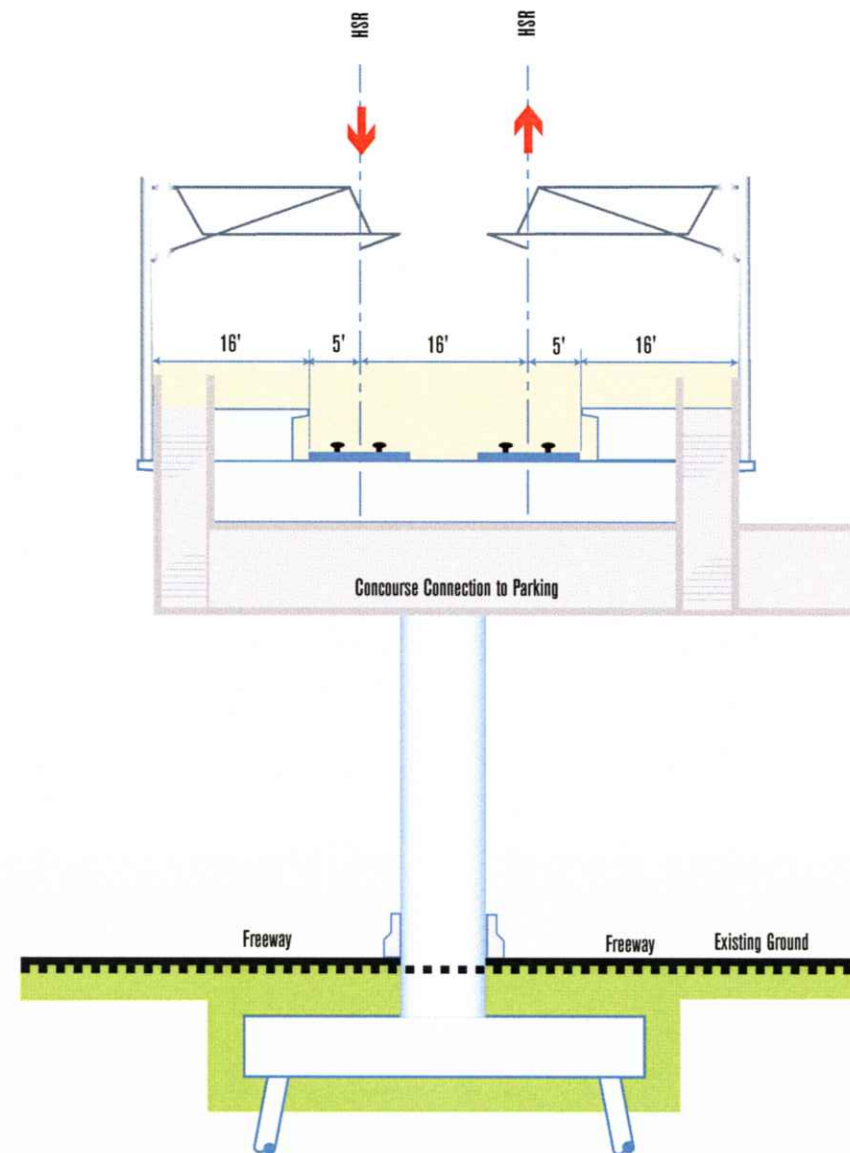


**2 BART Tracks on
Elevated Structure in
I-680 Freeway Median**

SECTION 9

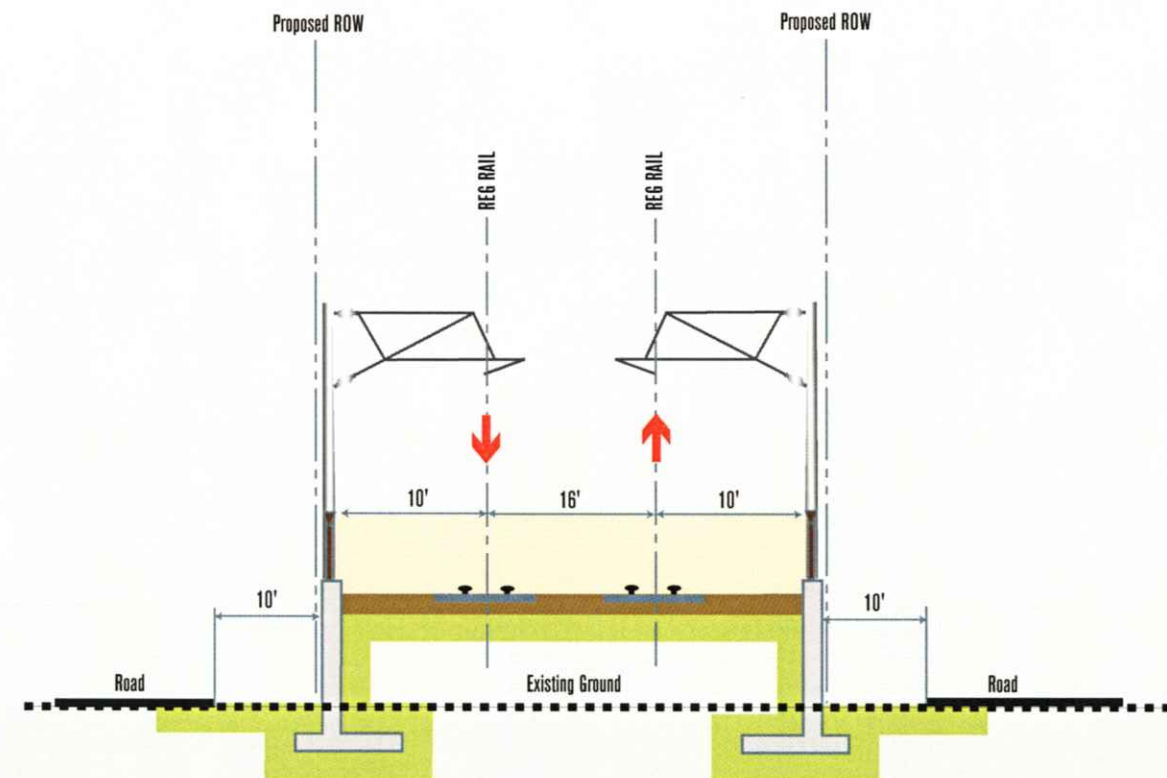


2 Tracks on Elevated Structure



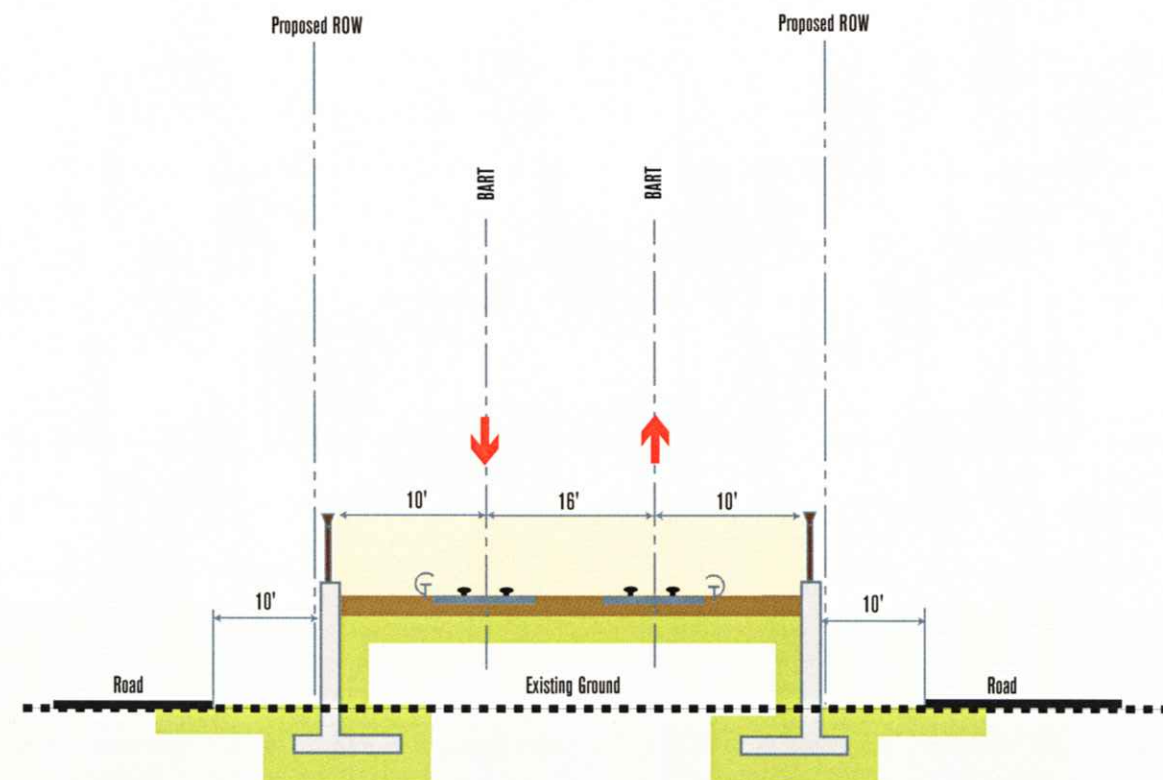
2 Track Elevated Structure Section at Station

SECTION 10



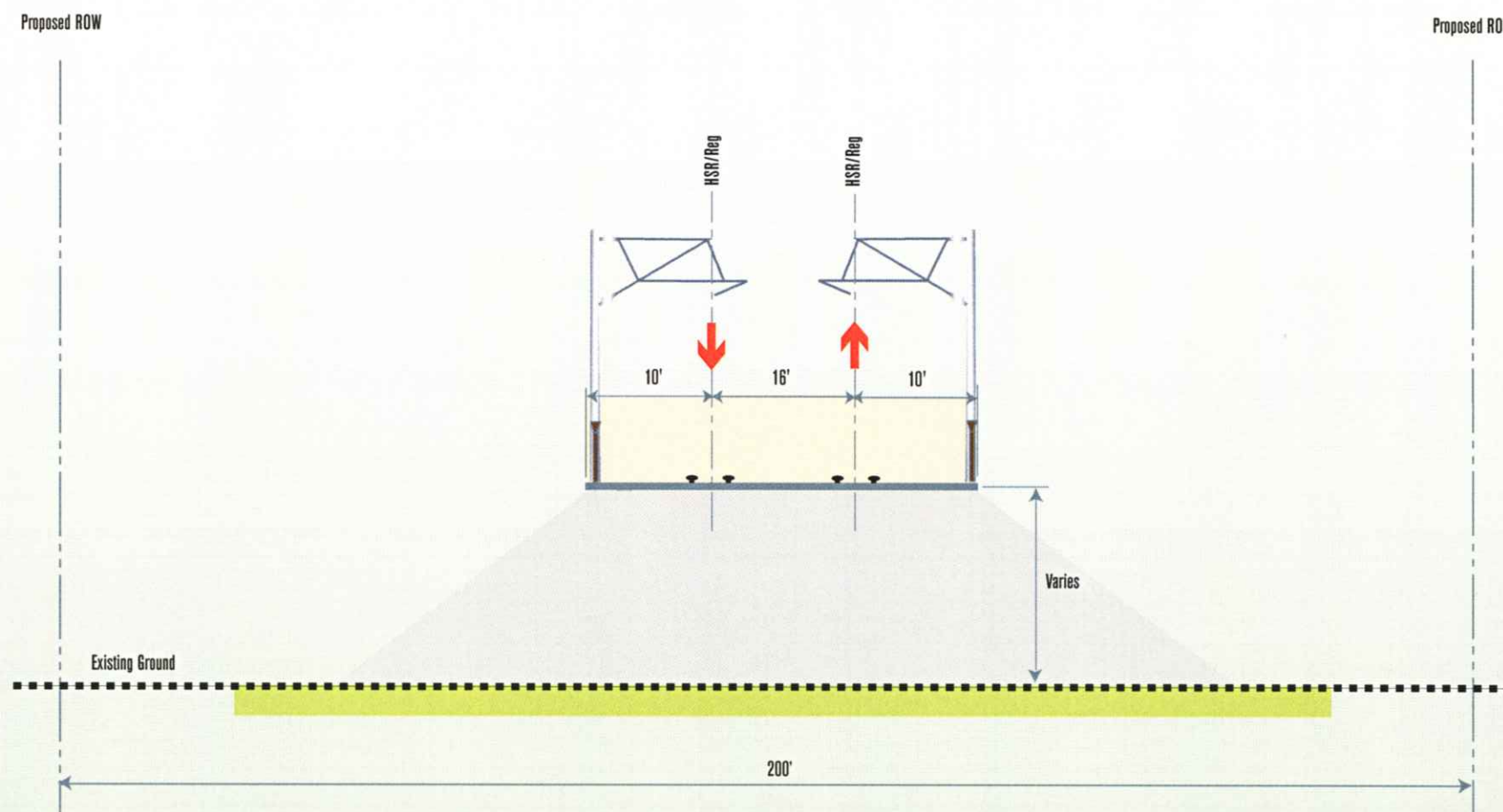
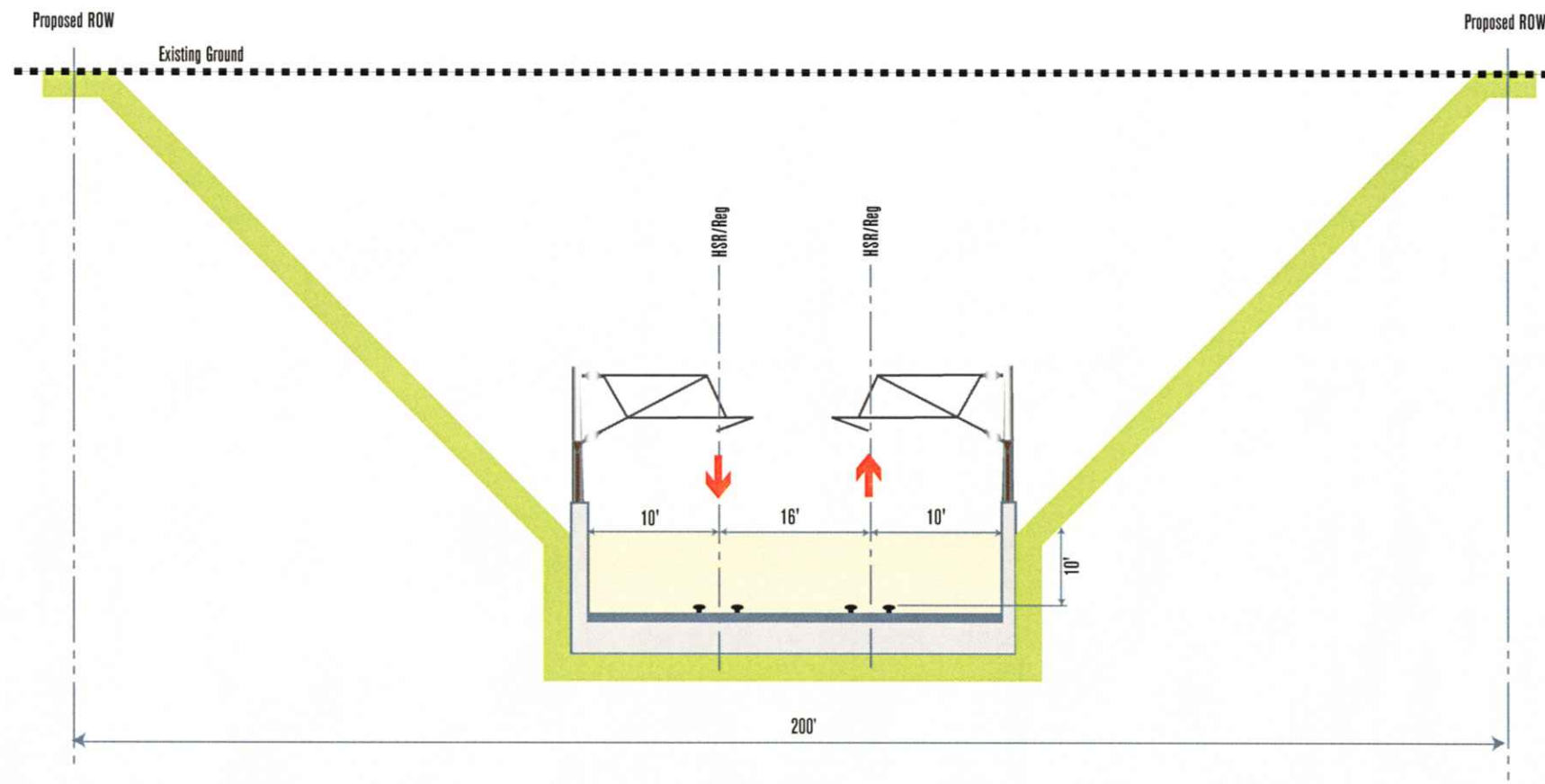
2 Track on Retained Fill

Section 11



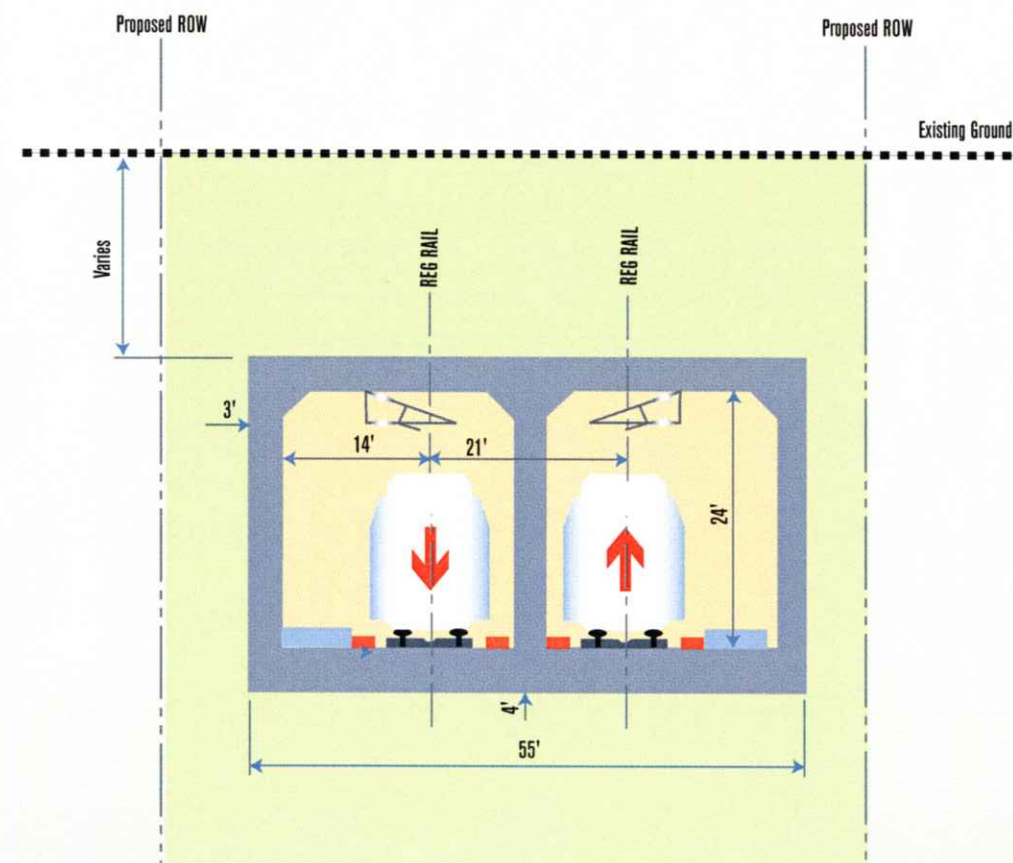
2 BART Track on Retained Fill

Section 11.1



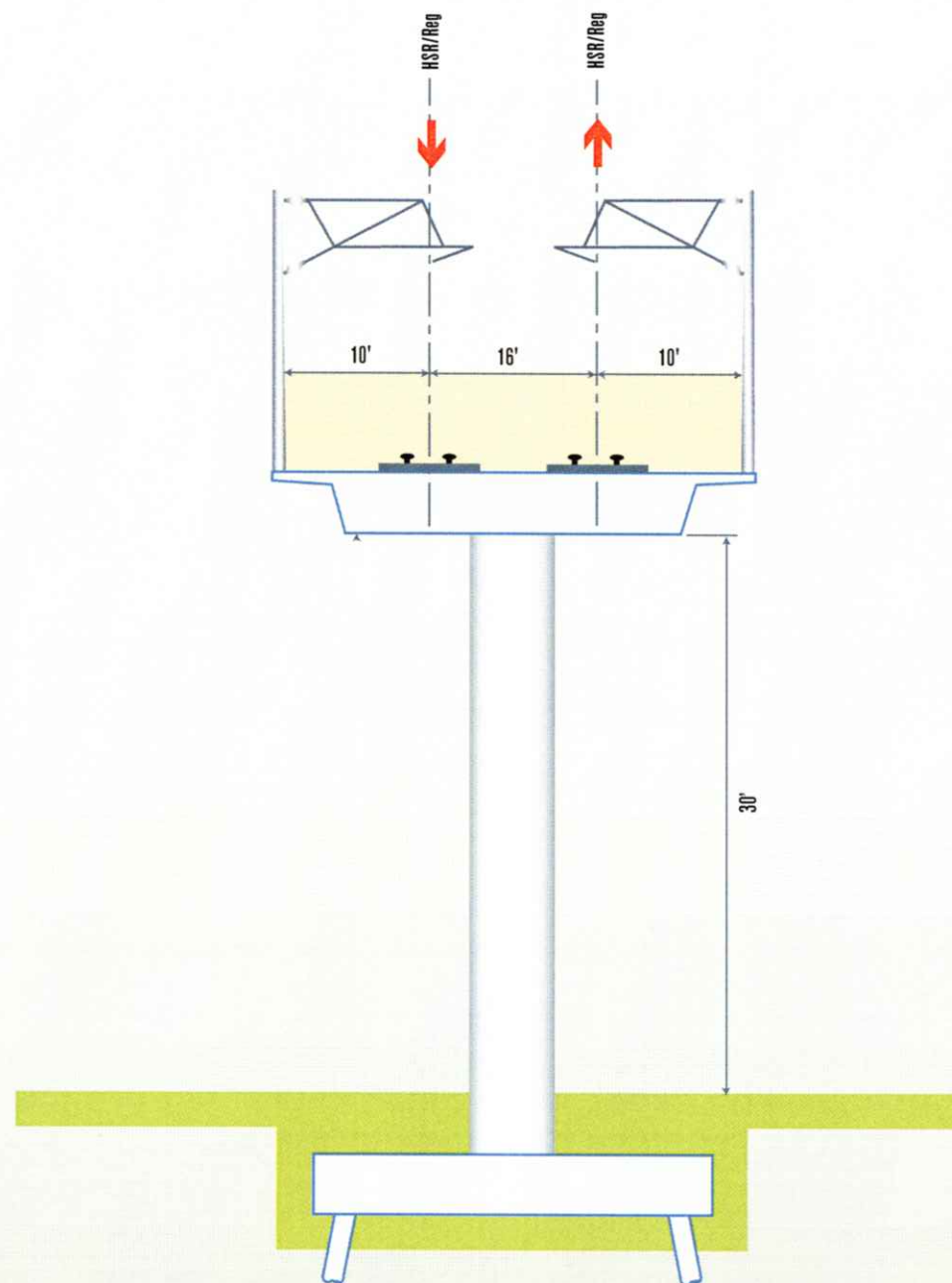
2 Tracks on Balanced Earth Work (Retained Cut or Embankment)

SECTION 12



2 Tracks Cut and Cover

SECTION 13



2 Tracks on Elevated Structure

Section 14